Final Environmental Indicators (EI) Report

Millennium Petrochemicals, Inc.
ILD005078126 – Douglas County – 0418080002

Equistar Chemicals, LP – Tuscola Plant
625 East US Hwy 35 / Tuscola, Illinois

Volume 4 of 4
Appendices K through P

Clayton Project No. 15-00116.03
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Prepared for:
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Clayton℠
GROUP SERVICES

FINAL ENVIRONMENTAL INDICATORS (EI) REPORT

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APPENDIX K

KASKASKIA RIVER DAILY MEAN DISCHARGE RATE AT CHESTERVILLE, ILLINOIS FROM USGS GAUGING STATION

US GEOLOGICAL SURVEY
DAILY MEAN DISCHARGE DATA
#
Station name   Il
Station number: 05590950
latitude (ddmmss)............................ 394212
longitude (dddmmss).......................... 0882317
state code.................................. 17
county...................................... Douglas
hydrologic unit code........................ 07140201
basin name.................................. Upper Kaskaskia
drainage area (square miles)................ 358
contributing drainage area (square miles).....
gage datum (feet above NGVD)................ 600
base discharge (cubic ft/sec)................
WATSTORE parameter code...................... 00060
WATSTORE statistic code...................... 00003
Discharge is listed in the table in cubic feet per second.
#
Daily mean discharge data were retrieved from the
National Water Information System files called ADAPS.
#
Format of table is as follows.
Lines starting with the # character are comment lines describing the data
included in this file. The next line is a row of tab-delimited column
names that are Date and Discharge. The next line is a row of tab-delimited
data type codes that describe a 10-character-wide date (10d) and an
8-character-wide numeric value for discharge (8n). All following lines are
rows of tab-delimited data values of date (year.month.day) and discharge.
A value of "E" or "e" in the Flags field indicates that the discharge for
this day was estimated. Any other values shown in this field are irrelevant.
#
NOTE this file was requested from the NWIS-W software package
on Wed Mar 7 09:26:03 2001
Dates are now in YYYY.MM.DD format.
#
----Date Range In File----
1 1995.05.11-1999.09.30

U.S. GEOLO AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.
5/11/1995	1580	6/18/1995	170	7/26/1995	31	9/2/1995	9.6	10/10/1995	12
5/12/1995	1470	6/19/1995	160	7/27/1995	30	9/3/1995	9.9	10/11/1995	13
5/13/1995	1290	6/20/1995	150	7/28/1995	25	9/4/1995	9.5	10/12/1995	14
5/14/1995	1300	6/21/1995	300	7/29/1995	28	9/5/1995	9.1	10/13/1995	14
5/15/1995	1610	6/22/1995	485	7/30/1995	22	9/6/1995	8.3	10/14/1995	14
5/16/1995	1670	6/23/1995	376	7/31/1995	18	9/7/1995	7.9	10/15/1995	15
5/17/1995	2040	6/24/1995	360	8/1/1995	18	9/8/1995	25	10/16/1995	16
5/18/1995	4130	6/25/1995	420	8/2/1995	71	9/9/1995	34	10/17/1995	13
5/19/1995	5750	6/26/1995	363	8/3/1995	54	9/10/1995	26	10/18/1995	12
5/20/1995	5140	6/27/1995	280	8/4/1995	112	9/11/1995	15	10/19/1995	13
5/21/1995	3680	6/28/1995	235	8/5/1995	356	9/12/1995	11	10/20/1995	16
5/22/1995	2550	6/29/1995	231	8/6/1995	150	9/13/1995	11	10/21/1995	31
5/23/1995	1870	6/30/1995	203	8/7/1995	195	9/14/1995	8.2	10/22/1995	26
5/24/1995	1500	7/1/1995	168	8/8/1995	415	9/15/1995	8.3	10/23/1995	17
5/25/1995	1990	7/2/1995	145	8/9/1995	367	9/16/1995	9.1	10/24/1995	14
5/26/1995	2430	7/3/1995	132	8/10/1995	316	9/17/1995	11	10/25/1995	17
5/27/1995	2050	7/4/1995	129	8/11/1995	230	9/18/1995	12	10/26/1995	19
5/28/1995	1810	7/5/1995	125	8/12/1995	120	9/19/1995	12	10/27/1995	16
5/29/1995	2060	7/6/1995	115	8/13/1995	69	9/20/1995	11	10/28/1995	17
5/30/1995	1930	7/7/1995	98	8/14/1995	46	9/21/1995	11	10/29/1995	22
5/31/1995	1540	7/8/1995	86	8/15/1995	34	9/22/1995	12	10/30/1995	18
6/1/1995	1000	7/9/1995	79	8/16/1995	27	9/23/1995	12	10/31/1995	16
6/2/1995	850	7/10/1995	75	8/17/1995	23	9/24/1995	11	11/1/1995	31
6/3/1995	700	7/11/1995	68	8/18/1995	20	9/25/1995	9.9	11/2/1995	40
6/4/1995	600	7/12/1995	62	8/19/1995	19	9/26/1995	9.6	11/3/1995	67
6/5/1995	520	7/13/1995	57	8/20/1995	24	9/27/1995	9.5	11/4/1995	66
6/6/1995	450	7/14/1995	51	8/21/1995	43	9/28/1995	9.7	11/5/1995	46
6/7/1995	410	7/15/1995	46	8/22/1995	28	9/29/1995	13	11/6/1995	37
6/8/1995	370	7/16/1995	44	8/23/1995	19	9/30/1995	12	11/7/1995	42
6/9/1995	340	7/17/1995	46	8/24/1995	15	10/1/1995	11	11/8/1995	46
6/10/1995	320	7/18/1995	37	8/25/1995	14	10/2/1995	11	11/9/1995	43
6/11/1995	400	7/19/1995	33	8/26/1995	13	10/3/1995	14	11/10/1995	35
6/12/1995	310	7/20/1995	30	8/27/1995	12	10/4/1995	25	11/11/1995	47
6/13/1995	270	7/21/1995	29	8/28/1995	11	10/5/1995	23	11/12/1995	140
6/14/1995	240	7/22/1995	28	8/29/1995	10	10/6/1995	13	11/13/1995	107
6/15/1995	210	7/23/1995	35	8/30/1995	10	10/7/1995	12	11/14/1995	77
6/16/1995	190	7/24/1995	39	8/31/1995	9.7	10/8/1995	16	11/15/1995	60
6/17/1995	180	7/25/1995	41	9/1/1995	9.4	10/9/1995	13	11/16/1995	52

U.S. GEOLO AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.
11/17/1995	44
11/18/1995	41
11/19/1995	56
11/20/1995	44
11/21/1995	42
11/22/1995	37
11/23/1995	30
11/24/1995	29
11/25/1995	24
11/26/1995	23
11/27/1995	24
11/28/1995	22
11/29/1995	23
11/30/1995	20
12/1/1995	18
12/2/1995	20
12/3/1995	19
12/4/1995	17
12/5/1995	15
12/6/1995	15
12/7/1995	16
12/8/1995	14
12/9/1995	11
12/10/1995	9.5
12/11/1995	8.8
12/12/1995	8.6
12/13/1995	8.6
12/14/1995	10
12/15/1995	13
12/16/1995	17
12/17/1995	23
12/18/1995	28
12/19/1995	68
12/20/1995	159
12/21/1995	120
12/22/1995	100
12/23/1995	80
12/24/1995	65

DATE	CUBIC FT/SEC.
12/25/1995	54
12/26/1995	47
12/27/1995	43
12/28/1995	40
12/29/1995	40
12/30/1995	45
12/31/1995	50
1/1/1996	48
1/2/1996	45
1/3/1996	43
1/4/1996	40
1/5/1996	37
1/6/1996	35
1/7/1996	33
1/8/1996	32
1/9/1996	31
1/10/1996	30
1/11/1996	30
1/12/1996	32
1/13/1996	35
1/14/1996	37
1/15/1996	39
1/16/1996	42
1/17/1996	120
1/18/1996	600
1/19/1996	1100
1/20/1996	800
1/21/1996	660
1/22/1996	511
1/23/1996	436
1/24/1996	689
1/25/1996	638
1/26/1996	471
1/27/1996	346
1/28/1996	241
1/29/1996	275
1/30/1996	177
1/31/1996	130

DATE	CUBIC FT/SEC.
2/1/1996	100
2/2/1996	85
2/3/1996	80
2/4/1996	76
2/5/1996	70
2/6/1996	74
2/7/1996	80
2/8/1996	90
2/9/1996	100
2/10/1996	120
2/11/1996	152
2/12/1996	107
2/13/1996	83
2/14/1996	93
2/15/1996	78
2/16/1996	57
2/17/1996	50
2/18/1996	48
2/19/1996	48
2/20/1996	48
2/21/1996	48
2/22/1996	50
2/23/1996	60
2/24/1996	76
2/25/1996	76
2/26/1996	80
2/27/1996	359
2/28/1996	902
2/29/1996	878
3/1/1996	648
3/2/1996	466
3/3/1996	268
3/4/1996	200
3/5/1996	237
3/6/1996	540
3/7/1996	694
3/8/1996	481
3/9/1996	399

DATE	CUBIC FT/SEC.
3/10/1996	383
3/11/1996	254
3/12/1996	181
3/13/1996	170
3/14/1996	163
3/15/1996	154
3/16/1996	144
3/17/1996	135
3/18/1996	127
3/19/1996	116
3/20/1996	113
3/21/1996	103
3/22/1996	121
3/23/1996	128
3/24/1996	137
3/25/1996	198
3/26/1996	184
3/27/1996	126
3/28/1996	113
3/29/1996	116
3/30/1996	110
3/31/1996	145
4/1/1996	551
4/2/1996	834
4/3/1996	729
4/4/1996	575
4/5/1996	406
4/6/1996	284
4/7/1996	245
4/8/1996	216
4/9/1996	183
4/10/1996	156
4/11/1996	145
4/12/1996	149
4/13/1996	151
4/14/1996	125
4/15/1996	116
4/16/1996	129

DATE	CUBIC FT/SEC.
4/17/1996	106
4/18/1996	96
4/19/1996	237
4/20/1996	415
4/21/1996	319
4/22/1996	869
4/23/1996	1300
4/24/1996	1270
4/25/1996	1030
4/26/1996	820
4/27/1996	612
4/28/1996	547
4/29/1996	2200
4/30/1996	2580
5/1/1996	2030
5/2/1996	1520
5/3/1996	1200
5/4/1996	1780
5/5/1996	2280
5/6/1996	1880
5/7/1996	1460
5/8/1996	2200
5/9/1996	6210
5/10/1996	6770
5/11/1996	7320
5/12/1996	4770
5/13/1996	2700
5/14/1996	1790
5/15/1996	1430
5/16/1996	1240
5/17/1996	1100
5/18/1996	957
5/19/1996	816
5/20/1996	704
5/21/1996	621
5/22/1996	529
5/23/1996	461
5/24/1996	431

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DATE	CUBIC FT/SEC.
5/25/1996	509
5/26/1996	1360
5/27/1996	3030
5/28/1996	3540
5/29/1996	2680
5/30/1996	1850
5/31/1996	1350
6/1/1996	1050
6/2/1996	1090
6/3/1996	1230
6/4/1996	1130
6/5/1996	929
6/6/1996	753
6/7/1996	667
6/8/1996	597
6/9/1996	581
6/10/1996	1750
6/11/1996	2830
6/12/1996	2700
6/13/1996	1790
6/14/1996	1240
6/15/1996	928
6/16/1996	741
6/17/1996	806
6/18/1996	1170
6/19/1996	957
6/20/1996	723
6/21/1996	570
6/22/1996	461
6/23/1996	378
6/24/1996	362
6/25/1996	369
6/26/1996	282
6/27/1996	235
6/28/1996	211
6/29/1996	195
6/30/1996	180
7/1/1996	166

DATE	CUBIC FT/SEC.
7/2/1996	151
7/3/1996	143
7/4/1996	119
7/5/1996	105
7/6/1996	97
7/7/1996	91
7/8/1996	86
7/9/1996	80
7/10/1996	70
7/11/1996	60
7/12/1996	54
7/13/1996	49
7/14/1996	47
7/15/1996	57
7/16/1996	56
7/17/1996	41
7/18/1996	34
7/19/1996	31
7/20/1996	29
7/21/1996	32
7/22/1996	76
7/23/1996	65
7/24/1996	40
7/25/1996	40
7/26/1996	39
7/27/1996	28
7/28/1996	25
7/29/1996	22
7/30/1996	33
7/31/1996	29
8/1/1996	26
8/2/1996	21
8/3/1996	18
8/4/1996	15
8/5/1996	13
8/6/1996	12
8/7/1996	12
8/8/1996	11

DATE	CUBIC FT/SEC.
8/9/1996	11
8/10/1996	10
8/11/1996	9.6
8/12/1996	9.5
8/13/1996	9.4
8/14/1996	9
8/15/1996	8.7
8/16/1996	8.6
8/17/1996	9.6
8/18/1996	12
8/19/1996	40
8/20/1996	32
8/21/1996	16
8/22/1996	14
8/23/1996	20
8/24/1996	25
8/25/1996	20
8/26/1996	11
8/27/1996	11
8/28/1996	15
8/29/1996	12
8/30/1996	14
8/31/1996	13
9/1/1996	11
9/2/1996	9.6
9/3/1996	9.1
9/4/1996	9.2
9/5/1996	10
9/6/1996	9.2
9/7/1996	10
9/8/1996	16
9/9/1996	54
9/10/1996	32
9/11/1996	16
9/12/1996	11
9/13/1996	10
9/14/1996	10
9/15/1996	8.8

DATE	CUBIC FT/SEC.
9/16/1996	11
9/17/1996	11
9/18/1996	11
9/19/1996	9.4
9/20/1996	8.6
9/21/1996	8.6
9/22/1996	8.8
9/23/1996	8.5
9/24/1996	8.6
9/25/1996	9.2
9/26/1996	9.1
9/27/1996	13
9/28/1996	30
9/29/1996	15
9/30/1996	11
10/1/1996	8.7
10/2/1996	9.6
10/3/1996	8.3
10/4/1996	9
10/5/1996	9
10/6/1996	9.4
10/7/1996	9.2
10/8/1996	9.4
10/9/1996	10
10/10/1996	11
10/11/1996	11
10/12/1996	9.8
10/13/1996	8.3
10/14/1996	7.5
10/15/1996	8.1
10/16/1996	7.8
10/17/1996	8.3
10/18/1996	10
10/19/1996	14
10/20/1996	13
10/21/1996	11
10/22/1996	11
10/23/1996	13

DATE	CUBIC FT/SEC.
10/24/1996	24
10/25/1996	19
10/26/1996	12
10/27/1996	9.5
10/28/1996	8.7
10/29/1996	15
10/30/1996	17
10/31/1996	22
11/1/1996	24
11/2/1996	17
11/3/1996	13
11/4/1996	11
11/5/1996	10
11/6/1996	11
11/7/1996	47
11/8/1996	158
11/9/1996	131
11/10/1996	57
11/11/1996	33
11/12/1996	23
11/13/1996	19
11/14/1996	18
11/15/1996	16
11/16/1996	17
11/17/1996	19
11/18/1996	23
11/19/1996	25
11/20/1996	15
11/21/1996	13
11/22/1996	13
11/23/1996	13
11/24/1996	13
11/25/1996	29
11/26/1996	117
11/27/1996	109
11/28/1996	69
11/29/1996	57
11/30/1996	102

U.S. GEOLC AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.
12/1/1996	245
12/2/1996	264
12/3/1996	200
12/4/1996	146
12/5/1996	115
12/6/1996	113
12/7/1996	117
12/8/1996	128
12/9/1996	121
12/10/1996	100
12/11/1996	98
12/12/1996	89
12/13/1996	76
12/14/1996	64
12/15/1996	61
12/16/1996	67
12/17/1996	79
12/18/1996	67
12/19/1996	58
12/20/1996	53
12/21/1996	50
12/22/1996	50
12/23/1996	60
12/24/1996	70
12/25/1996	82
12/26/1996	60
12/27/1996	56
12/28/1996	57
12/29/1996	64
12/30/1996	56
12/31/1996	49
1/1/1997	47
1/2/1997	50
1/3/1997	55
1/4/1997	60
1/5/1997	85
1/6/1997	122
1/7/1997	88

DATE	CUBIC FT/SEC.
1/8/1997	85
1/9/1997	90
1/10/1997	95
1/11/1997	70
1/12/1997	45
1/13/1997	45
1/14/1997	46
1/15/1997	48
1/16/1997	52
1/17/1997	35
1/18/1997	30
1/19/1997	27
1/20/1997	26
1/21/1997	35
1/22/1997	311
1/23/1997	959
1/24/1997	1160
1/25/1997	997
1/26/1997	736
1/27/1997	556
1/28/1997	360
1/29/1997	280
1/30/1997	250
1/31/1997	220
2/1/1997	300
2/2/1997	497
2/3/1997	828
2/4/1997	1140
2/5/1997	1440
2/6/1997	1260
2/7/1997	883
2/8/1997	609
2/9/1997	440
2/10/1997	354
2/11/1997	303
2/12/1997	261
2/13/1997	209
2/14/1997	199

DATE	CUBIC FT/SEC.
2/15/1997	178
2/16/1997	155
2/17/1997	136
2/18/1997	142
2/19/1997	206
2/20/1997	363
2/21/1997	1070
2/22/1997	1580
2/23/1997	1490
2/24/1997	1150
2/25/1997	863
2/26/1997	812
2/27/1997	2290
2/28/1997	3050
3/1/1997	2320
3/2/1997	1640
3/3/1997	1280
3/4/1997	1040
3/5/1997	892
3/6/1997	757
3/7/1997	635
3/8/1997	556
3/9/1997	535
3/10/1997	767
3/11/1997	934
3/12/1997	798
3/13/1997	668
3/14/1997	1100
3/15/1997	1430
3/16/1997	1180
3/17/1997	891
3/18/1997	737
3/19/1997	655
3/20/1997	600
3/21/1997	559
3/22/1997	509
3/23/1997	426
3/24/1997	359

DATE	CUBIC FT/SEC.
3/25/1997	341
3/26/1997	342
3/27/1997	298
3/28/1997	294
3/29/1997	316
3/30/1997	328
3/31/1997	286
4/1/1997	246
4/2/1997	224
4/3/1997	220
4/4/1997	224
4/5/1997	234
4/6/1997	250
4/7/1997	221
4/8/1997	171
4/9/1997	146
4/10/1997	137
4/11/1997	145
4/12/1997	169
4/13/1997	173
4/14/1997	141
4/15/1997	119
4/16/1997	117
4/17/1997	118
4/18/1997	113
4/19/1997	121
4/20/1997	132
4/21/1997	123
4/22/1997	118
4/23/1997	108
4/24/1997	99
4/25/1997	95
4/26/1997	86
4/27/1997	83
4/28/1997	96
4/29/1997	94
4/30/1997	86
5/1/1997	83

DATE	CUBIC FT/SEC.
5/2/1997	87
5/3/1997	132
5/4/1997	679
5/5/1997	842
5/6/1997	686
5/7/1997	528
5/8/1997	420
5/9/1997	373
5/10/1997	301
5/11/1997	254
5/12/1997	243
5/13/1997	232
5/14/1997	214
5/15/1997	195
5/16/1997	164
5/17/1997	145
5/18/1997	155
5/19/1997	151
5/20/1997	156
5/21/1997	127
5/22/1997	104
5/23/1997	98
5/24/1997	102
5/25/1997	117
5/26/1997	161
5/27/1997	218
5/28/1997	202
5/29/1997	165
5/30/1997	155
5/31/1997	178
6/1/1997	256
6/2/1997	339
6/3/1997	350
6/4/1997	308
6/5/1997	268
6/6/1997	238
6/7/1997	221
6/8/1997	267

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Daily Mean Discharge Data

DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.
6/9/1997	497	7/17/1997	38	8/24/1997	30	10/1/1997	19	11/8/1997	57
6/10/1997	699	7/18/1997	26	8/25/1997	105	10/2/1997	18	11/9/1997	54
6/11/1997	630	7/19/1997	19	8/26/1997	113	10/3/1997	17	11/10/1997	46
6/12/1997	539	7/20/1997	18	8/27/1997	58	10/4/1997	16	11/11/1997	38
6/13/1997	1690	7/21/1997	20	8/28/1997	37	10/5/1997	16	11/12/1997	33
6/14/1997	2230	7/22/1997	35	8/29/1997	29	10/6/1997	15	11/13/1997	30
6/15/1997	1930	7/23/1997	79	8/30/1997	26	10/7/1997	16	11/14/1997	32
6/16/1997	1480	7/24/1997	46	8/31/1997	22	10/8/1997	18	11/15/1997	32
6/17/1997	1100	7/25/1997	25	9/1/1997	19	10/9/1997	18	11/16/1997	35
6/18/1997	806	7/26/1997	17	9/2/1997	25	10/10/1997	21	11/17/1997	32
6/19/1997	612	7/27/1997	14	9/3/1997	137	10/11/1997	21	11/18/1997	30
6/20/1997	481	7/28/1997	12	9/4/1997	233	10/12/1997	18	11/19/1997	29
6/21/1997	402	7/29/1997	9.7	9/5/1997	90	10/13/1997	18	11/20/1997	27
6/22/1997	353	7/30/1997	9	9/6/1997	44	10/14/1997	19	11/21/1997	28
6/23/1997	295	7/31/1997	8.6	9/7/1997	31	10/15/1997	29	11/22/1997	32
6/24/1997	247	8/1/1997	7.9	9/8/1997	34	10/16/1997	19	11/23/1997	31
6/25/1997	224	8/2/1997	10	9/9/1997	663	10/17/1997	16	11/24/1997	28
6/26/1997	208	8/3/1997	12	9/10/1997	799	10/18/1997	15	11/25/1997	26
6/27/1997	191	8/4/1997	12	9/11/1997	402	10/19/1997	15	11/26/1997	26
6/28/1997	169	8/5/1997	11	9/12/1997	160	10/20/1997	14	11/27/1997	25
6/29/1997	154	8/6/1997	12	9/13/1997	82	10/21/1997	13	11/28/1997	30
6/30/1997	144	8/7/1997	11	9/14/1997	56	10/22/1997	13	11/29/1997	106
7/1/1997	174	8/8/1997	8.9	9/15/1997	44	10/23/1997	12	11/30/1997	373
7/2/1997	187	8/9/1997	11	9/16/1997	36	10/24/1997	13	12/1/1997	777
7/3/1997	129	8/10/1997	13	9/17/1997	33	10/25/1997	14	12/2/1997	752
7/4/1997	102	8/11/1997	14	9/18/1997	32	10/26/1997	16	12/3/1997	547
7/5/1997	88	8/12/1997	13	9/19/1997	29	10/27/1997	25	12/4/1997	373
7/6/1997	79	8/13/1997	20	9/20/1997	33	10/28/1997	37	12/5/1997	256
7/7/1997	70	8/14/1997	18	9/21/1997	59	10/29/1997	30	12/6/1997	184
7/8/1997	59	8/15/1997	14	9/22/1997	48	10/30/1997	22	12/7/1997	142
7/9/1997	54	8/16/1997	16	9/23/1997	37	10/31/1997	17	12/8/1997	127
7/10/1997	78	8/17/1997	42	9/24/1997	38	11/1/1997	18	12/9/1997	117
7/11/1997	53	8/18/1997	383	9/25/1997	41	11/2/1997	25	12/10/1997	228
7/12/1997	43	8/19/1997	275	9/26/1997	30	11/3/1997	31	12/11/1997	478
7/13/1997	39	8/20/1997	146	9/27/1997	26	11/4/1997	25	12/12/1997	473
7/14/1997	36	8/21/1997	82	9/28/1997	24	11/5/1997	24	12/13/1997	365
7/15/1997	44	8/22/1997	42	9/29/1997	23	11/6/1997	26	12/14/1997	278
7/16/1997	72	8/23/1997	32	9/30/1997	20	11/7/1997	46	12/15/1997	217

U.S. GEOLC AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.
12/16/1997	182
12/17/1997	162
12/18/1997	142
12/19/1997	125
12/20/1997	112
12/21/1997	99
12/22/1997	112
12/23/1997	167
12/24/1997	241
12/25/1997	637
12/26/1997	810
12/27/1997	667
12/28/1997	498
12/29/1997	385
12/30/1997	314
12/31/1997	239
1/1/1998	162
1/2/1998	192
1/3/1998	177
1/4/1998	175
1/5/1998	242
1/6/1998	635
1/7/1998	973
1/8/1998	1320
1/9/1998	1920
1/10/1998	1960
1/11/1998	1520
1/12/1998	1130
1/13/1998	750
1/14/1998	510
1/15/1998	450
1/16/1998	390
1/17/1998	340
1/18/1998	290
1/19/1998	260
1/20/1998	235
1/21/1998	221
1/22/1998	215

DATE	CUBIC FT/SEC.
1/23/1998	207
1/24/1998	196
1/25/1998	180
1/26/1998	171
1/27/1998	188
1/28/1998	282
1/29/1998	376
1/30/1998	382
1/31/1998	335
2/1/1998	298
2/2/1998	262
2/3/1998	236
2/4/1998	210
2/5/1998	206
2/6/1998	194
2/7/1998	174
2/8/1998	160
2/9/1998	149
2/10/1998	142
2/11/1998	173
2/12/1998	338
2/13/1998	380
2/14/1998	322
2/15/1998	272
2/16/1998	261
2/17/1998	358
2/18/1998	792
2/19/1998	988
2/20/1998	896
2/21/1998	775
2/22/1998	665
2/23/1998	589
2/24/1998	525
2/25/1998	457
2/26/1998	410
2/27/1998	420
2/28/1998	433
3/1/1998	396

DATE	CUBIC FT/SEC.
3/2/1998	361
3/3/1998	337
3/4/1998	311
3/5/1998	275
3/6/1998	243
3/7/1998	229
3/8/1998	314
3/9/1998	914
3/10/1998	1340
3/11/1998	1240
3/12/1998	982
3/13/1998	781
3/14/1998	738
3/15/1998	747
3/16/1998	713
3/17/1998	804
3/18/1998	1640
3/19/1998	2150
3/20/1998	2260
3/21/1998	3110
3/22/1998	3050
3/23/1998	2240
3/24/1998	1630
3/25/1998	1280
3/26/1998	1060
3/27/1998	889
3/28/1998	1340
3/29/1998	2650
3/30/1998	2470
3/31/1998	1730
4/1/1998	1340
4/2/1998	1170
4/3/1998	1010
4/4/1998	1340
4/5/1998	1720
4/6/1998	1480
4/7/1998	1180
4/8/1998	1300

DATE	CUBIC FT/SEC.
4/9/1998	1430
4/10/1998	1190
4/11/1998	928
4/12/1998	744
4/13/1998	650
4/14/1998	678
4/15/1998	710
4/16/1998	670
4/17/1998	599
4/18/1998	502
4/19/1998	446
4/20/1998	406
4/21/1998	388
4/22/1998	389
4/23/1998	353
4/24/1998	324
4/25/1998	307
4/26/1998	304
4/27/1998	280
4/28/1998	234
4/29/1998	265
4/30/1998	729
5/1/1998	1390
5/2/1998	1580
5/3/1998	1960
5/4/1998	3620
5/5/1998	4180
5/6/1998	2830
5/7/1998	1890
5/8/1998	2020
5/9/1998	2210
5/10/1998	1730
5/11/1998	1280
5/12/1998	1010
5/13/1998	819
5/14/1998	824
5/15/1998	756
5/16/1998	637

DATE	CUBIC FT/SEC.
5/17/1998	535
5/18/1998	450
5/19/1998	408
5/20/1998	555
5/21/1998	865
5/22/1998	810
5/23/1998	1230
5/24/1998	2170
5/25/1998	2820
5/26/1998	2570
5/27/1998	1740
5/28/1998	1230
5/29/1998	952
5/30/1998	762
5/31/1998	657
6/1/1998	576
6/2/1998	496
6/3/1998	438
6/4/1998	385
6/5/1998	371
6/6/1998	358
6/7/1998	310
6/8/1998	278
6/9/1998	545
6/10/1998	924
6/11/1998	860
6/12/1998	1050
6/13/1998	2100
6/14/1998	2270
6/15/1998	2410
6/16/1998	3620
6/17/1998	3380
6/18/1998	2660
6/19/1998	2330
6/20/1998	2440
6/21/1998	1900
6/22/1998	1400
6/23/1998	2040

U.S. GEOLC AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.	DATE	CUBIC FT/SEC.
6/24/1998	2150	8/1/1998	106	9/8/1998	8.1	10/16/1998	13	11/23/1998	22
6/25/1998	1650	8/2/1998	62	9/9/1998	6.8	10/17/1998	13	11/24/1998	21
6/26/1998	1190	8/3/1998	48	9/10/1998	4.7	10/18/1998	17	11/25/1998	21
6/27/1998	917	8/4/1998	40	9/11/1998	6.4	10/19/1998	22	11/26/1998	22
6/28/1998	742	8/5/1998	40	9/12/1998	5.5	10/20/1998	22	11/27/1998	24
6/29/1998	640	8/6/1998	45	9/13/1998	6.2	10/21/1998	16	11/28/1998	19
6/30/1998	902	8/7/1998	62	9/14/1998	6.4	10/22/1998	13	11/29/1998	16
7/1/1998	1090	8/8/1998	77	9/15/1998	6.2	10/23/1998	13	11/30/1998	21
7/2/1998	873	8/9/1998	94	9/16/1998	7	10/24/1998	9.8	12/1/1998	22
7/3/1998	653	8/10/1998	84	9/17/1998	11	10/25/1998	8.8	12/2/1998	21
7/4/1998	538	8/11/1998	134	9/18/1998	11	10/26/1998	10	12/3/1998	16
7/5/1998	501	8/12/1998	78	9/19/1998	6.7	10/27/1998	16	12/4/1998	14
7/6/1998	427	8/13/1998	45	9/20/1998	7.4	10/28/1998	17	12/5/1998	16
7/7/1998	487	8/14/1998	34	9/21/1998	17	10/29/1998	26	12/6/1998	19
7/8/1998	1090	8/15/1998	29	9/22/1998	17	10/30/1998	22	12/7/1998	17
7/9/1998	1080	8/16/1998	25	9/23/1998	7.2	10/31/1998	32	12/8/1998	21
7/10/1998	769	8/17/1998	22	9/24/1998	5.9	11/1/1998	24	12/9/1998	21
7/11/1998	547	8/18/1998	21	9/25/1998	8.1	11/2/1998	18	12/10/1998	20
7/12/1998	408	8/19/1998	22	9/26/1998	17	11/3/1998	25	12/11/1998	17
7/13/1998	318	8/20/1998	19	9/27/1998	8.9	11/4/1998	39	12/12/1998	17
7/14/1998	254	8/21/1998	16	9/28/1998	8.1	11/5/1998	38	12/13/1998	20
7/15/1998	207	8/22/1998	16	9/29/1998	7.8	11/6/1998	33	12/14/1998	20
7/16/1998	176	8/23/1998	14	9/30/1998	11	11/7/1998	26	12/15/1998	20
7/17/1998	150	8/24/1998	13	10/1/1998	12	11/8/1998	28	12/16/1998	20
7/18/1998	128	8/25/1998	13	10/2/1998	19	11/9/1998	28	12/17/1998	19
7/19/1998	111	8/26/1998	13	10/3/1998	11	11/10/1998	33	12/18/1998	20
7/20/1998	101	8/27/1998	11	10/4/1998	9.7	11/11/1998	101	12/19/1998	19
7/21/1998	99	8/28/1998	11	10/5/1998	10	11/12/1998	79	12/20/1998	21
7/22/1998	71	8/29/1998	11	10/6/1998	12	11/13/1998	45	12/21/1998	25
7/23/1998	118	8/30/1998	11	10/7/1998	27	11/14/1998	37	12/22/1998	21
7/24/1998	218	8/31/1998	9.2	10/8/1998	24	11/15/1998	32	12/23/1998	18
7/25/1998	129	9/1/1998	10	10/9/1998	16	11/16/1998	30	12/24/1998	23
7/26/1998	86	9/2/1998	11	10/10/1998	11	11/17/1998	28	12/25/1998	22
7/27/1998	66	9/3/1998	10	10/11/1998	10	11/18/1998	28	12/26/1998	17
7/28/1998	57	9/4/1998	9.6	10/12/1998	10	11/19/1998	27	12/27/1998	14
7/29/1998	50	9/5/1998	9.7	10/13/1998	10	11/20/1998	24	12/28/1998	13
7/30/1998	51	9/6/1998	9.2	10/14/1998	14	11/21/1998	20	12/29/1998	12
7/31/1998	139	9/7/1998	8.6	10/15/1998	14	11/22/1998	20	12/30/1998	12

U.S. GEOLC AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.
12/31/1998	11
1/1/1999	11
1/2/1999	10
1/3/1999	10
1/4/1999	10
1/5/1999	9.5
1/6/1999	13
1/7/1999	16
1/8/1999	15
1/9/1999	13
1/10/1999	12
1/11/1999	11
1/12/1999	11
1/13/1999	12
1/14/1999	12
1/15/1999	12
1/16/1999	13
1/17/1999	14
1/18/1999	60
1/19/1999	200
1/20/1999	170
1/21/1999	210
1/22/1999	951
1/23/1999	2470
1/24/1999	3180
1/25/1999	2560
1/26/1999	1700
1/27/1999	1220
1/28/1999	1000
1/29/1999	798
1/30/1999	614
1/31/1999	565
2/1/1999	864
2/2/1999	1030
2/3/1999	926
2/4/1999	750
2/5/1999	586
2/6/1999	517

DATE	CUBIC FT/SEC.
2/7/1999	933
2/8/1999	2320
2/9/1999	2430
2/10/1999	1690
2/11/1999	1220
2/12/1999	1060
2/13/1999	1000
2/14/1999	807
2/15/1999	643
2/16/1999	571
2/17/1999	533
2/18/1999	502
2/19/1999	469
2/20/1999	432
2/21/1999	384
2/22/1999	330
2/23/1999	309
2/24/1999	304
2/25/1999	282
2/26/1999	261
2/27/1999	255
2/28/1999	278
3/1/1999	252
3/2/1999	223
3/3/1999	310
3/4/1999	380
3/5/1999	430
3/6/1999	400
3/7/1999	360
3/8/1999	330
3/9/1999	340
3/10/1999	370
3/11/1999	320
3/12/1999	330
3/13/1999	410
3/14/1999	460
3/15/1999	450
3/16/1999	400

DATE	CUBIC FT/SEC.
3/17/1999	370
3/18/1999	330
3/19/1999	309
3/20/1999	260
3/21/1999	258
3/22/1999	244
3/23/1999	214
3/24/1999	203
3/25/1999	188
3/26/1999	165
3/27/1999	155
3/28/1999	153
3/29/1999	150
3/30/1999	135
3/31/1999	130
4/1/1999	142
4/2/1999	144
4/3/1999	130
4/4/1999	136
4/5/1999	128
4/6/1999	120
4/7/1999	130
4/8/1999	113
4/9/1999	200
4/10/1999	316
4/11/1999	348
4/12/1999	456
4/13/1999	373
4/14/1999	270
4/15/1999	322
4/16/1999	1040
4/17/1999	1880
4/18/1999	1860
4/19/1999	1430
4/20/1999	1090
4/21/1999	1220
4/22/1999	1860
4/23/1999	1550

DATE	CUBIC FT/SEC.
4/24/1999	1080
4/25/1999	800
4/26/1999	633
4/27/1999	563
4/28/1999	554
4/29/1999	569
4/30/1999	530
5/1/1999	477
5/2/1999	441
5/3/1999	420
5/4/1999	394
5/5/1999	386
5/6/1999	396
5/7/1999	371
5/8/1999	319
5/9/1999	261
5/10/1999	225
5/11/1999	213
5/12/1999	207
5/13/1999	331
5/14/1999	563
5/15/1999	568
5/16/1999	498
5/17/1999	433
5/18/1999	436
5/19/1999	578
5/20/1999	547
5/21/1999	468
5/22/1999	443
5/23/1999	479
5/24/1999	450
5/25/1999	382
5/26/1999	295
5/27/1999	237
5/28/1999	202
5/29/1999	184
5/30/1999	170
5/31/1999	164

DATE	CUBIC FT/SEC.
6/1/1999	196
6/2/1999	921
6/3/1999	1280
6/4/1999	1180
6/5/1999	1420
6/6/1999	1650
6/7/1999	1440
6/8/1999	1030
6/9/1999	744
6/10/1999	552
6/11/1999	443
6/12/1999	380
6/13/1999	355
6/14/1999	541
6/15/1999	635
6/16/1999	497
6/17/1999	362
6/18/1999	270
6/19/1999	221
6/20/1999	195
6/21/1999	180
6/22/1999	300
6/23/1999	306
6/24/1999	286
6/25/1999	364
6/26/1999	299
6/27/1999	286
6/28/1999	336
6/29/1999	261
6/30/1999	192
7/1/1999	149
7/2/1999	135
7/3/1999	112
7/4/1999	93
7/5/1999	79
7/6/1999	69
7/7/1999	63
7/8/1999	56

U.S. GEOLC AL SURVEY
Daily Mean Discharge Data

DATE	CUBIC FT/SEC.
7/9/1999	50
7/10/1999	46
7/11/1999	41
7/12/1999	36
7/13/1999	32
7/14/1999	29
7/15/1999	26
7/16/1999	23
7/17/1999	22
7/18/1999	20
7/19/1999	23
7/20/1999	21
7/21/1999	38
7/22/1999	28
7/23/1999	22
7/24/1999	18
7/25/1999	32
7/26/1999	19
7/27/1999	12
7/28/1999	63
7/29/1999	75
7/30/1999	48
7/31/1999	28
8/1/1999	22
8/2/1999	20
8/3/1999	8.6
8/4/1999	16
8/5/1999	15
8/6/1999	13
8/7/1999	12
8/8/1999	14
8/9/1999	57
8/10/1999	33
8/11/1999	19
8/12/1999	15
8/13/1999	98
8/14/1999	591
8/15/1999	822

DATE	CUBIC FT/SEC.
8/16/1999	498
8/17/1999	181
8/18/1999	84
8/19/1999	49
8/20/1999	35
8/21/1999	28
8/22/1999	23
8/23/1999	19
8/24/1999	20
8/25/1999	26
8/26/1999	27
8/27/1999	19
8/28/1999	12
8/29/1999	9
8/30/1999	7.8
8/31/1999	7.5
9/1/1999	8.7
9/2/1999	14
9/3/1999	13
9/4/1999	13
9/5/1999	9.2
9/6/1999	8.1
9/7/1999	10
9/8/1999	11
9/9/1999	11
9/10/1999	11
9/11/1999	9.5
9/12/1999	11
9/13/1999	12
9/14/1999	8.6
9/15/1999	5.8
9/16/1999	5.4
9/17/1999	5.4
9/18/1999	5.2
9/19/1999	4.8
9/20/1999	8.1
9/21/1999	7.1
9/22/1999	9.9

DATE	CUBIC FT/SEC.
9/23/1999	9.7
9/24/1999	8.9
9/25/1999	8.8
9/26/1999	9.9
9/27/1999	10
9/28/1999	9.2
9/29/1999	19
9/30/1999	40

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 03/09/2001

STATION NUMBER 05590950 KASKASKIA RIVER AT CHESTERVILLE, IL STREAM SOURCE AGENCY USGS
LATITUDE 394211 LONGITUDE 0882311 DRAINAGE AREA 358 DATUM 600 STATE 17 COUNTY 041
PROVISIONAL DATA SUBJECT TO REVISION

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	14	e18	14	33	e23	129	79	109	1060	355	58	79
2	13	e20	14	33	e24	115	76	114	781	277	54	58
3	13	30	15	34	e25	92	77	118	578	232	159	47
4	19	28	15	48	e25	89	69	104	429	201	94	41
5	29	28	17	58	e26	88	64	107	370	843	56	37
6	21	27	36	41	e27	81	58	91	448	1710	59	35
7	19	26	35	47	e28	68	68	85	456	1310	54	37
8	21	26	27	40	e29	68	69	87	371	923	39	34
9	37	25	25	36	e30	68	62	94	297	635	35	34
10	44	24	25	36	e32	66	55	112	250	437	33	191
11	39	26	27	37	e55	59	51	121	240	877	30	480
12	30	25	25	38	96	56	73	103	258	1750	28	370
13	27	22	24	34	81	61	57	118	503	1400	26	249
14	26	19	26	32	70	69	53	239	700	987	24	152
15	27	18	40	26	63	71	57	206	654	689	22	101
16	e24	21	45	35	51	67	59	158	560	482	20	79
17	e23	24	42	32	48	58	76	135	441	324	20	66
18	e23	24	39	25	63	51	207	125	313	221	21	62
19	e23	21	38	e22	342	51	178	126	238	174	24	54
20	e22	18	e33	e20	499	129	141	185	202	136	21	54
21	e21	17	e28	e19	387	351	142	166	928	112	20	53
22	e21	17	e23	e18	267	344	140	134	1320	101	22	49
23	e20	20	e22	e18	208	244	126	157	1180	86	43	49
24	e19	23	e21	e18	166	187	127	149	1010	73	123	99
25	e19	27	e22	e18	147	173	192	106	1230	60	71	366
26	e18	23	22	e18	118	148	228	84	1180	58	51	807
27	e18	21	25	e19	144	133	194	172	1000	53	511	812
28	e17	21	28	e20	175	131	162	620	804	46	590	654
29	e17	20	28	e21	143	112	141	1490	616	45	433	490
30	e17	16	33	e21	---	90	120	1650	465	54	243	355
31	e18	---	34	e22	---	86	---	1420	---	78	122	---
TOTAL	699	675	848	919	3392	3533	3201	8886	18892	14729	3106	5994
MEAN	22.5	22.5	27.4	29.6	117	114	107	287	629	475	100	200
MAX	44	30	45	58	499	351	228	1850	1320	1750	590	812
MIN	13	16	14	18	23	51	51	84	202	45	20	34
CFSM	.06	.06	.08	.08	.33	.32	.30	.80	1.76	1.33	.28	.56
IN.	.07	.07	.09	.10	.35	.37	.33	.92	1.96	1.53	.32	.62

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1995 - 2000, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	15.8	37.3	101	310	440	527	454	910	737	177	64.9	59.3
MAX	22.5	46.5	329	529	793	1233	769	2146	1378	475	100	200
(WY)	2000	1996	1998	1998	1997	1998	1998	1996	1998	2000	2000	2000
MIN	11.4	22.5	18.3	29.6	117	114	107	247	370	48.6	15.1	8.98
(WY)	1997	2000	1999	2000	2000	2000	2000	1997	1995	1999	1996	1998

SUMMARY STATISTICS	FOR 1999 CALENDAR YEAR	FOR 2000 WATER YEAR	WATER YEARS 1995 - 2000
ANNUAL TOTAL	102112.7	64864	
ANNUAL MEAN	280	177	327

October 1, 2000 through April 20, 2001

TIME SERIES RECORD
#
YEAR MONTH DAY DAILYQ
12N 12N 12N 12N

2000	10	1	262
2000	10	2	211
2000	10	3	178
2000	10	4	157
2000	10	5	848
2000	10	6	1510
2000	10	7	1370
2000	10	8	1080
2000	10	9	810
2000	10	10	615
2000	10	11	479
2000	10	12	372
2000	10	13	299
2000	10	14	263
2000	10	15	250
2000	10	16	255
2000	10	17	240
2000	10	18	217
2000	10	19	195
2000	10	20	181
2000	10	21	182
2000	10	22	175
2000	10	23	162
2000	10	24	158
2000	10	25	163
2000	10	26	163
2000	10	27	167
2000	10	28	170
2000	10	29	154
2000	10	30	138
2000	10	31	128
2000	11	1	128
2000	11	2	131
2000	11	3	129
2000	11	4	119

2000	11	5	108
2000	11	6	111
2000	11	7	191
2000	11	8	268
2000	11	9	341
2000	11	10	908
2000	11	11	1180
2000	11	12	1040
2000	11	13	894
2000	11	14	862
2000	11	15	780
2000	11	16	668
2000	11	17	577
2000	11	18	486
2000	11	19	413
2000	11	20	364
2000	11	21	307
2000	11	22	261
2000	11	23	241
2000	11	24	228
2000	11	25	243
2000	11	26	406
2000	11	27	530
2000	11	28	502
2000	11	29	435
2000	11	30	372
2000	12	1	315
2000	12	2	278
2000	12	3	246
2000	12	4	231
2000	12	5	231
2000	12	6	218
2000	12	7	211
2000	12	8	214
2000	12	9	187
2000	12	10	166
2000	12	11	207
2000	12	12	435
2000	12	13	515
2000	12	14	453
2000	12	15	393
2000	12	16	337
2000	12	17	290

2000	12	18	279
2000	12	19	317
2000	12	20	264
2000	12	21	234
2000	12	22	204
2000	12	23	183
2000	12	24	190
2000	12	25	178
2000	12	26	167
2000	12	27	176
2000	12	28	189
2000	12	29	189
2000	12	30	184
2000	12	31	168
2001	1	1	154
2001	1	2	145
2001	1	3	138
2001	1	4	143
2001	1	5	156
2001	1	6	155
2001	1	7	149
2001	1	8	144
2001	1	9	130
2001	1	10	116
2001	1	11	116
2001	1	12	126
2001	1	13	131
2001	1	14	162
2001	1	15	340
2001	1	16	482
2001	1	17	491
2001	1	18	395
2001	1	19	313
2001	1	20	255
2001	1	21	198
2001	1	22	190
2001	1	23	192
2001	1	24	176
2001	1	25	156
2001	1	26	142
2001	1	27	157
2001	1	28	148
2001	1	29	211

2001	1	30	1090
2001	1	31	2150
2001	2	1	1700
2001	2	2	1100
2001	2	3	784
2001	2	4	587
2001	2	5	480
2001	2	6	422
2001	2	7	390
2001	2	8	421
2001	2	9	746
2001	2	10	1420
2001	2	11	1460
2001	2	12	1100
2001	2	13	832
2001	2	14	719
2001	2	15	916
2001	2	16	1030
2001	2	17	906
2001	2	18	729
2001	2	19	608
2001	2	20	541
2001	2	21	466
2001	2	22	401
2001	2	23	372
2001	2	24	352
2001	2	25	1110
2001	2	26	2670
2001	2	27	2280
2001	2	28	1470
2001	3	1	1100
2001	3	2	884
2001	3	3	737
2001	3	4	638
2001	3	5	564
2001	3	6	488
2001	3	7	429
2001	3	8	388
2001	3	9	355
2001	3	10	318
2001	3	11	297
2001	3	12	281
2001	3	13	284

2001	3	14	267
2001	3	15	240
2001	3	16	286
2001	3	17	447
2001	3	18	517
2001	3	19	479
2001	3	20	437
2001	3	21	-1.23E+25
2001	3	22	368
2001	3	23	330
2001	3	24	295
2001	3	25	262
2001	3	26	239
2001	3	27	226
2001	3	28	215
2001	3	29	214
2001	3	30	214
2001	3	31	203
2001	4	1	196
2001	4	2	182
2001	4	3	167
2001	4	4	155
2001	4	5	143
2001	4	6	156
2001	4	7	168
2001	4	8	-1.23E+25
2001	4	9	154
2001	4	10	150
2001	4	11	697
2001	4	12	1070
2001	4	13	867
2001	4	14	639
2001	4	15	512
2001	4	16	431
2001	4	17	349
2001	4	18	285
2001	4	19	254
2001	4	20	-1.23E+25

APPENDIX L

STANDARD OPERATING PROCEDURES

Clayton
GROUP SERVICES

APPENDIX L-1

EQUIPMENT DECONTAMINATION

Standard Operating Procedure No. 500

EQUIPMENT DECONTAMINATION

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 500 describes the guidelines for decontamination of personnel and equipment during hazardous waste investigation field activities as specified in the Pre-RA Activities Work Plans or as otherwise specified.

2.0 EXECUTION

2.1 GENERAL REQUIREMENTS

A. A decontamination plan should be developed and sufficiently scoped to address all the expected types and levels of contaminants at the site and the methods used to investigate them. Until proven otherwise, the decontamination plan should assume that all personnel and equipment exiting the area of potential contamination are contaminated and, therefore, comprehensive decontamination procedures must be implemented. Procedures for decontamination of equipment as well as personal protective clothing and safety equipment is included in the Site Health and Safety Plan (SHSP).

B. Personnel involved in decontamination efforts will be equipped with the same protective equipment as those conducting onsite investigations until a lower level of risk can be confirmed.

C. Procedures for decontamination of field personnel should be specifically addressed in the SHSP. These procedures should be followed and incorporated with the equipment decontamination procedures contained in the SAP to minimize exposure and cross-contamination potential.

D. Decontamination activities should be documented to verify that proper procedures are followed. Documentation shall be in accordance with the requirements specified in the Work Plan and/or Quality Assurance Project Plan (QAPP).

E. The methods described in this SOP are considered sufficient for most hazardous waste investigations. However, more intensive site-specific procedures may be required under highly toxic or other "non-routine" conditions. In these cases, advice of in-house or consulting industrial hygienists and/or organic chemists may be of assistance in determining specific procedures necessary for decontamination.

F. Decontamination procedures may be subject to federal, state, local and/or the client's regulations. All regulatory requirements must be satisfied but the procedures adopted should be no less rigorous than those presented in this SOP.

G. Climatic conditions anticipated during the decontamination activities may play a significant factor in the procedures selected. Special facilities may be needed to compensate for weather conditions such as temporary heated structures for winter work and wind screens for dust prevention. It may be necessary to establish special work conditions during periods of high heat stress.

2.2 SITE FACILITIES AND SUPPLIES

2.2.1 **Site Selection**

A. The equipment decontamination facility should be in an area where contaminants can be controlled and at the boundary of a "clean" zone. The location should also be selected to prevent equipment from being exposed to additional or other contamination. On large projects a formal "Contamination Reduction Zone" should be established in which all decontamination efforts will be conducted. This area should be conspicuously marked as "off-limits" to all personnel not involved with the decontamination process.

B. Due to the volume of wastewater generated, if permitted, the equipment decontamination area should be located where decontamination fluids and oily wastes can be easily discarded or discharged into controlled areas of waste such as existing pits or lagoons, if the potential mixing of contaminants is allowed.

However, this should be prohibited until all investigation activity in those areas is complete.

C. The decontamination area should have adequate storage area for storing unused drums, used drums containing spent decontamination fluids and waste, and trash containers, until such time that they can be relocated or disposed offsite.

2.2.2 Decontamination Pad

A. Some sites under investigation may have an existing decontamination area. If an area has previously been constructed, it should be evaluated for logistics capabilities such as water supply, electrical power, by-product handling capabilities and cleanness. If the existing area can be utilized or modified for use, the savings in costs and level of effort may be significant.

B. On small projects where only hand sampling or other small equipment is being used, several small wash tubs (filled with detergent and potable water) may be sufficient for decontamination.

2.2.3 Water Supply

A. Large volumes of water, often exceeding 1,000 gallons per day, may be required for cleaning, especially for drill rigs and other large equipment. The water used for equipment decontamination must be clean, potable water; municipal water supplies are generally adequate.

B. Stainless-steel tank trucks or aluminum (if stainless steel is not available) can be used for onsite storage of the water supply. These tankers can be transported easily and are not excessively expensive. Typically, a week's supply of water can be stored onsite.

C. Water may also be stored in open top, water tight tanks or roll-off boxes located in the clean zone on the site. However, open top tanks or box containers should not be used if airborne contaminants are present, unless a liner is used to cover the container. Containers should be steam cleaned and acid-washed prior to use. Only containers used to store fresh water or inert materials should be used. Never use containers previously used to store petroleum products or organic chemicals.

2.2.4 Cleaning Equipment and Supplies

A. A portable steam cleaner or high-pressure hot water washer is normally required to clean contaminated heavy machinery (e.g. drill rig, backhoe, etc.) as well as materials and associated tools. Most washers and steam cleaners are commercially available for both portable generators or supplied AC power. Site logistical considerations may control the type of equipment required.

B. Typical steam cleaners/washers operate on relatively low water consumption rates (2 to 6 gpm) and can be used in conjunction with other cleaning fluids mixed with the water. High-pressure steam is preferred to high-pressure water because of steam's greater ability to volatilize organics and to remove oil and grease from equipment.

C. Units tend to malfunction easily and are susceptible to frequent maintenance and repair (especially under frequent use or use below freezing conditions). If at all possible, a second or back-up unit should be available onsite or arranged for with a nearby vendor.

D. On some small projects, garden sprayers may be utilized for final rinsing or cleaning. Typically, these sprayers are limited to use with small hand tools or sampling equipment. They also tend to break down and malfunction quickly.

E. Miscellaneous items required for decontamination efforts include some of the following:

- Potable water supply
- Decontamination solution
  - potable water
  - distilled water
  - mild detergent (such as Alconox)
  - isopropanol
- Brushes - to remove heavy mud, dust, etc.

- Buckets
- Steam cleaner or high-pressure, hot water washer
- Racks – normally metal (not wood) to hold miscellaneous equipment such as drill rods, sampling tools, etc.
- Utility pump – to collect spent fluids for containerizing
- Drums – to store contaminated materials (personal protective equipment, etc.)
- Tables – (not wood) to hold small items after/during cleaning
- Plastic sheeting – to wrap decontaminated equipment, tools, etc., after cleaning

2.3 EQUIPMENT AND VEHICLE DECONTAMINATION PROCEDURES

A. The following procedures are presented as a function of the level of contaminant concentration and are intended as general guidelines. Appropriate site procedures should be established based on the individual site characteristics and type of investigation prescribed.

1. Low to Moderate Contaminant Concentration:

   a. steam or water rinse with potable water to remove mud or dirt;

   b. steam or hot water wash with a mixture of detergent and potable water;

   c. steam or hot water rinse with clean, potable water;

   d. and air dry.

2. High Contaminant Concentration:

a. steam rinse with potable water to remove mud or dirt;

b. steam wash with a mixture of detergent and potable water or other type of decontamination solution;

c. rinse critical pieces of sampling equipment with isopropanol;

d. steam rinse with clean, potable water;

e. and air dry.

B. During decontamination of drilling equipment and accessories, clean hollow-stem auger flights, drill rods, and drill bits (particularly roller bits), as well as all couplings and threads. Generally, decontamination can be limited to the back portion of the drill rig and those parts which come in direct contact with samples or casing, or drilling equipment that is placed into or over the borehole.

C. Some items of drilling equipment cannot typically be decontaminated; these included wood materials (planks, etc.), porous hoses, engine air filters, etc. These items should not be removed from the site until ready to dispose of in an appropriate manner.

Other drilling equipment (especially rotary drill rigs) that require extensive decontamination are water or grout pumps. Flushing may be sufficient to clean them. However, if high concentration of constituents or visible product is known to exist, then disassembly and thorough cleaning of internal parts is required prior to removal of the equipment from the site.

D. The mud pumps, kelly, swivel, kelly and suction hoses on rotary drill rigs should be cleaned by circulating a minimum of 1,000 gallons of clean water and cleaning solution through the system followed by a minimum of 200 gallons of clean water through the system, and finally rinsing with 50 gallons of clean water without recirculating the fluid.

2.4 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

A. All sampling equipment which may contribute to the contamination of a sample must be thoroughly decontaminated prior to its initial use, unless specific documentation exists that the sampling equipment has been decontaminated.

B. Generally, sampling equipment can be cleaned by hand. The following procedure is given as a typical sequence which should be modified based on site conditions.

C. Split-spoon and shelby tube samplers, bailers, and other sampling equipment that can be cleaned by hand shall be decontaminated as follows:

1. Wash and scrub with detergent (non-ionic).
2. Tap water rinse.
3. Isopropanol rinse.
4. Distilled water rinse.
5. Air dry.
6. Wrap in aluminum foil, shiny side out, for transport.

D. Steel tapes, water probes, transducers, thermometers, and water quality meters shall be rinsed in distilled water or cleaned in a detergent solution and rinsed in distilled water after each use.

E. All pumps will be cleaned in water/detergent solution and flushed with clean water after each use.

F. Use of high pressure steam or hot water washing may be substituted for hand scrubbing if it effectively removes contaminants and soil and can be done safely without burning or contaminating the personnel. Special racks should be used to hold equipment while high pressure washing.

G. More "complicated" samplers require more "complicated" decontamination procedures. Piston and other samplers with numerous internal parts should be avoided, if possible, on sites requiring extensive decontamination procedures.

2.5 WELL MATERIALS DECONTAMINATION PROCEDURES

Well-casing, whether constructed of PVC, stainless steel, or other materials will be cleaned with a steam cleaner or high-pressure, hot water washer before it is installed. All well construction materials will be handled while wearing latex gloves.

2.6 DISPOSAL PRACTICES

2.6.1 General Disposal Requirements

A. Proper disposal of decontamination, sampling and drilling by-products shall be conducted to prevent the spread of contaminants offsite and to protect individuals who may come in contact with the potentially hazardous materials.

B. Disposal practices shall be in accordance with the procedures specified in the Work Plan. In general, sampling, drilling and decontamination by-products should be collected and disposed in a manner consistent with the accepted disposal practices for the type and concentration of wastes which may be contained in the by-products.

C. Contaminated equipment or solutions will not be discarded in any manner which may lead to contamination of the environment by the migration of hazardous constituents from the site by air, surface, or subsurface transport mechanisms.

2.6.2 Onsite Disposal

A. Certain materials which are not contaminated or contain very low levels of contamination may be disposed of onsite. Such materials may include drill cuttings, wash water, drilling fluids and water removed in developing or flushing wells. The low level of contamination in these materials should be confirmed prior to onsite disposal.

B. On controlled, secured facilities, most contaminated materials may remain on the site, provided they do not pose a threat of contamination of personnel or areas to be sampled.

2.6.3 Offsite Disposal

A. Materials which cannot be disposed of onsite will require that specific procedures be developed to provide for offsite disposal. Storage areas and/or tanks will be provided to hold the material onsite prior to disposal. Offsite disposal may be appropriate at various locations depending upon the nature of the waste.

B. Consideration should be given to use of sanitary and storm sewer systems, sanitary landfills and licensed hazardous waste disposal facilities. Offsite disposal of wastes must comply with local, state and federal laws and regulations. The Work Plan should identify the waste disposal options appropriate for offsite disposal of various classes of waste materials.

APPENDIX L-2

SURFACE WATER, SEDIMENT, AND SLUDGE SAMPLING

Standard Operating Procedure No. 405

SURFACE WATER, SEDIMENT, AND SLUDGE SAMPLING

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 405 describes the guidelines for obtaining surface water, sediment, and sludge samples as stated in the RA Work Plan or as otherwise specified. Sampling surface water, sediment, and/or sludges is conducted for the purpose of chemical and physical analysis to evaluate and characterize impacts to surface water bodies (i.e, rivers, streams, ponds, lakes, etc) and/or to characterize waste sources (i.e., ponds and impoundments).

2.0 EXECUTION

2.1 GENERAL REQUIREMENTS

A. Many of the same techniques that apply to soil sampling (SOP No. 200) also apply to the collection of surface water and sediment samples.

B. Surface water and sediment samples are examined to evaluate the presence of contaminants in various surface water bodies such as rivers, streams, ponds, and impoundments. Waste constituents may be dissolved in water, separate phase liquid, semi-solid, or solid in nature. Sampling techniques will vary according to the physical characteristics of the material.

C. If surface water, sediments, sludges, or wastes have the potential for being considered hazardous, disposable sampling equipment should be used.

D. Sampling equipment for materials dissolved in water include collection bottles, bailers, pails, and ladles. Equipment used to sample liquid materials typically consist of bailers, pails, and ladles. Semi-solid materials are usually collected using scoops, trowels, or dippers. Solid materials from relatively shallow depths can be collected with equipment used to collect soil samples such as scoops, trowels, hand augers, and coring tools.

E. Sampling sediment and semi-solid waste material at depths greater than 10 feet are typically obtained using drilling methods (e.g., floating barges, all-terrain vehicles). Sampling methods are provided in SOP No. 200.

F. Since sediment, sludge, and waste samples are collected in areas containing potentially high concentrations of hazardous waste, the appropriate health and safety guidelines should be followed.

2.2 SEDIMENT AND SLUDGE SAMPLING EQUIPMENT AND METH ODS

The sampling equipment and methods for collecting sediment and sludge samples are summarized below.

2.2.1 Trowels and Scoops

A. This method provides a quick and simple means of collecting sediment, sludge, and waste samples that are partially disturbed.

B. Insert trowel or scoop into material, remove sample, and place in the appropriate sample containers.

C. If compositing a series of grab samples, collect samples from at least three different areas within the sampling area and mix samples in a stainless-steel bowl or tray (except VOC samples). Transfer the composite sample in the appropriate sample containers.

D. If the materials being sampled have been exposed to air, the upper 1 to 2 inches of material should be removed prior to sampling.

2.2.2 Hand Corers

A. Hand corers or augers provide for the collection of a disturbed sample. Samples can be collected at depths up to 10-feet below the existing grade. The sampler can be adapted to hold liners consisting of brass, stainless steel, or plastic for collecting undisturbed samples. Care should be taken to select a liner that will not adversely impact the integrity of the sample.

B. Hand corers or augers are typically used to collect semi-solid to solid materials.

C. Twist and push coring device into media being sampled to the desired sampling depth interval.

D. Withdraw coring tool and remove sample from the auger head using a stainless-steel spatula or spoon. Place sample in the appropriate sample containers.

E. Decontaminate sampling equipment in accordance with SOP No. 500.

2.2.3 Gravity Corers

A. A gravity corer is a metal tube with a replaceable tapered nosepiece on the bottom of the core tube and a check or ball-valve at the top. The gravity core also has a four fins at the top of the core to maintain vertical penetration through the liquid and sampling media. The check valve allows liquid to pass through the corer as it descents into the sludge or sediment layer. Most corers are constructed of brass or stainless steel.

B. The gravity corer collects undisturbed samples. The profile or layering that may develop in the sediment or sludge is retained for observation and measurement.

C. Depending upon the texture and consistency of the sediment or sludge, penetration of up to 30 inches can be achieved from the gravity coring device.

D. Attach a known length of the sample line to the end of the gravity coring device. The sample line should consist of braided nylon rope.

E. Secure the free end of nylon rope to a fixed support to prevent losing the coring device.

F. Measure the marked distance to the top of the sludge or sediment layer to determine the approximate depth of penetration. Allow enough sample line to adequately penetrate the sludge or sediment.

G. Let the coring device free fall through the liquid, if present, into the sludge or sediment layer. Determine the depth of sample penetration from the length of sample line.

H. Retrieve the coring device carefully. Do not bump the coring device on the sides or walls of the storage unit to prevent sample loss.

I. Remove the nose piece or sample catcher from the coring device and slide sample on an aluminum or stainless-steel tray. Describe physical characteristics of the sample (i.e., color, water content, sediment size, etc.) and record in the field logbook.

J. Transfer the sample into appropriate sample containers.

K. Decontaminate the coring device in accordance with SOP No. 500.

2.2.4 Ponar Grab Sampler

A. Ponar or clamshell type samplers are typically used to collect disturbed samples of sludges and sediments ranging from silt to granular materials. The samplers vary in size and weights.

B. The sampler consists of a spring-loaded scoop that is activated by a center-lever system. The shell is opened and latched in place and slowly lowered to the bottom. When tension is released on the sample line, the latch is released and the clamshell closes, collecting a portion of sample from the bottom.

C. Attach a known length of sample line, as described above, to the ponar sampler.

D. Open the sampler until the sample jaws are latched.

E. Lower the sampler slowly down through the liquid, if present, to the top of the sampling media. The sampler will be triggered and the jaws will close upon impact with the sample medium.

F. Slowly retrieve the sampler and allow excess liquid, if present, to drain away.

G. Place the sample on an aluminum or stainless-steel tray.

H. Transfer the sample into the appropriate sample containers.

I. Decontaminate the sampler in accordance with SOP No. 500.

2.2.5 Bacon Sampler

A. A bacon sampler consist of a nickel plated brass cylindrical body (2-inch diameter) which is threaded for upper and lower covers. The lower cover is tapered with a plunger that acts as a valve to admit samples. The lock on the upper cover keeps the plunger closed after sampling. The upper cover has guide holes where drop cord and a line for controlling the plunger lock can be attached. The sampler's net weight is two pounds (0.9 kg).

B. The bacon sampler can retrieve an eight ounce sample of sludge, sediment, asphalt, or liquid from various levels within a storage tank.

C. Attach a known length of drop cord to the guide hole on the upper cover of the sampler. Attach another line to the plunger lock guide hole.

D. Lower the sampler to the desired depth and release the plunger lock line to collect the sample. After collecting the sample, close the plunger lock and retrieve the sampler.

E. Open the lower cover or release the plunger lock and transfer the sample into the appropriate sample containers.

F. Decontaminate the sampler in accordance with SOP No. 500.

2.3 SURFACE WATER SAMPLING EQUIPMENT AND METHODS

The sampling equipment and methods for collecting surface water samples is summarized below.

2.3.1 Collection Bottle

A. A wide-mouth, glass collection bottle with a minimum volume of 500mL is typically used to collected surface water samples at shallow depths. Surface water samples collected by this method should be in areas that are readily accessible, shallow, stagnant or slow flowing.

B. The optimum sample location should be at mid-depth and/or mid-stream, if applicable.

C. The sample is collected by submerging the bottle with a closed lid to the optimal sample depth. If flowing conditions are present, the mouth of the sample bottle should be pointed upstream. Sample personnel should also stand downstream and/or avoid stirring up sediment in the sampling area.

D. At the optimal depth, the collection bottle lid is opened slowly to collect the surface water sample. After the bottle is completely filled with no visible headspace, the bottle is removed to the surface to fill the sample bottles.

E. The surface water sample should be placed in the sample bottles as soon as possible. Agitation of the collection bottle should be avoided during the transfer of the bottle to the collection station.

F. The VOC vials are filled first. While filling the VOC vials, extreme care must be taken to prevent agitation and the formation of air bubbles in the vial. After the vial is completely filled, close the lid tightly and examine the bottle to observe any air bubbles or headspace. If the latter occurs, obtain a new vial and repeat the process. Fill the remaining bottles for any additional analyses.

G. If additional volumes of water are required to fill the sample bottles, repeat the steps discussed above to fill the collection bottle.

H. Properly discard or decontaminate the collection bottle in accordance with SOP No. 500.

2.3.2 Bailers and Weighted Bottle Samplers

A. Open-top and bottom bailers, and weighted bottle samplers are typically used to collect surface water samples in large and/or deep bodies of water. Samples should be collected near shore or from a boat, if feasible.

B. Samples should be collected at the locations and depths as specified in the Sampling and Analysis Plan.

C. If a stainless steel or Teflon bailer is used to collect the surface water sample, attach a nylon rope of sufficient length securely to the end of the bailer. Next, slowly lower the bailer to the specified sample depth. Extreme care must be taken not to lower the end of the bailer into the sediment as this could result in a non-representative sample and/or impede the collection of the surface water sample as the bailer is removed from the surface water body.

D. Raise the bailer slowly to the surface of the body of water to avoid agitation of the sample.

E. If a weighted bottle sampler is used to collect the surface water sample, attach a nylon rope of sufficient length securely to the end of the sampler and eyelet of the bottle plug. Next, slowly lower the weighted bottle without prematurely opening the bottle stopper to the specified sample depth. When the appropriate sample depth is reached, pull the stopper with a quick jerk of the nylon rope. Allow the bottle to fill completely. Observe the cessation of air bubbles rising to the surface of the water a guide when the bottle is completely filled.

F. Raise the weighted bottle to the surface slowly to the surface and cap the bottle.

G. Transfer the sample in the bailer or weighted bottle sampler and immediately fill the VOC vials first. While filling the VOC vials, extreme care must be taken to prevent agitation and the formation of air bubbles in the vial. After the vial is completely filled, close the lid tightly and examine the bottle to observe any air bubbles or headspace. If the latter occurs, obtain a new vial and repeat the process. Fill the remaining bottles for any additional analyses.

H. If additional volumes of water are required to fill the sample bottles, repeat the steps discussed above to fill the collection bottle.

I. Properly decontaminate the bailer or weighted bottle in accordance with SOP No. 500.

2.3.3 Pails, Ladles, and Pond Samplers

A. A pail or ladle with a minimum volume of 500mL is typically used to collected surface water samples at the surface of a water body. Surface water samples collected by this method should be in areas that are readily accessible, shallow, stagnant or slow flowing. The reach of the of the sample location can be extended by using a pond sampler with a fixed-length or telescoping handle.

B. The sample is collected by positioning the opening of the sampler perpendicular with water surface and slowly scooping the sample. Avoid plunging the sampler which would cause agitation of the water sample. If flowing conditions are present, the mouth of the sampler should be pointed upstream. Sample personnel should avoid stirring up sediment in the sample collection area.

C. The surface water sample should be placed in the sample bottles as soon as possible. Agitation of the collection bottle should be avoided during the transfer of the bottle to the collection station.

D. The VOC vials are filled first. While filling the VOC vials, extreme care must be taken to prevent agitation and the formation of air bubbles in the vial. After the vial is completely filled, close the lid tightly and examine the bottle to observe any air bubbles or headspace. If the latter occurs, obtain a new vial and repeat the process. Fill the remaining bottles for any additional analyses.

E. If additional volumes of water are required to fill the sample bottles, repeat the steps discussed above to fill the collection bottle.

H. Properly discard or decontaminate the collection bottle in accordance with SOP No. 500.

2.3.4 Peristaltic Pumps

A. A peristaltic pump can be used to collect surface water samples at depths less than 21 feet. In deep bodies of water, samples can be collected from a boat, if feasible.

B. The sample is collected via flexible Teflon or Tygon tubing installed in accordance with the manufacturers specifications. The appropriate length of tubing is lowered to the surface of the water body or to the specified sampling depth.

C. The sample is pumped directly into the samples bottles.

D. The VOC vials are filled first. While filling the VOC vials, extreme care must be taken to prevent agitation and the formation of air bubbles in the vial. After the vial is completely filled, close the lid tightly and examine the bottle to observe any air bubbles or headspace. If the latter occurs, obtain a new vial and repeat the process. Fill the remaining bottles for any additional analyses.

E. Properly dispose of the flexible tubing and decontaminate the pump in accordance with SOP No. 500.

2.4 SAMPLE HANDLING AND SPECIMEN PREPARATION

A. Samples will be handled, classified, stored, packaged, and shipped in accordance with SOP No. 911.

B. Samples will be placed in appropriate sample containers as specified in the Quality Assurance Project Plan (QAPP) and in accordance with SOP No. 900.

C. Sample handling and packaging will be in accordance with the site Health and Safety Plan.

3.0 DOCUMENTATION

A. Record sample data and field observations in accordance with requirements specified in SOP No. 120.

B. Document the sample location(s) in the field logbook and/or the listed activity form. Mark the sample location(s), if possible, with a wooden stake and measure the sample location(s) in reference to a permanent site feature on a scaled map.

C. Specific documentation procedures for sample classification and chain of custody control should be conducted in accordance with SOP Nos. 911 and 912.

D. Document decontamination procedures.

APPENDIX L-3

WELL INSTALLATION

WELL INSTALLATION

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 210 describes the guidelines for the installation of monitoring wells, recovery wells, and observation wells as described in the Work Plan, Field Operations Plan (FOP), or as otherwise specified. Monitoring wells and observation wells are installed to determine depth to groundwater and monitor fluctuations in groundwater elevation, to determine and monitor the depth and thickness of free phase petroleum products (if present), and obtain groundwater and/or free phase petroleum products samples for laboratory analysis. Recovery wells are installed to conduct groundwater pumping tests, free phase petroleum product recovery tests, and aquifer injection tests.

2.0 EXECUTION

2.1 DESIGN REQUIREMENTS

2.1.1 General Requirements

A. Well construction procedures should meet regulatory agency requirements. In addition, licensing and/or certification of the driller may be required.

B. A qualified geologist/hydrogeologist should be present during well installation to document the subsurface stratigraphy and construction details for each well.

C. The well designs should meet two basic criteria: (1) groundwater and/or other fluids (i.e. product) must move freely into the well, and (2) vertical migration of surface water or undesired groundwater to the well intake zone must, to the extent possible, be eliminated.

D. Factors which influence the location of wells should be considered and include the following:

1. Objectives of the Work Plan.
2. Location of facilities to be monitored.
3. Groundwater gradient.

4. Location of above-ground and underground utilities and man-made features.

5. Accessibility to desired areas.

2.1.2 Well Installation Materials Selection

A. Materials used in the construction of wells must remain essentially chemically inert with respect to free phase petroleum products and dissolved contaminants in the groundwater for the duration of the remedial action.

B. The most commonly used well construction materials are PVC and stainless steel. PVC is the least expensive and easiest material to use. It is generally believed that PVC does not decompose in contact with groundwater containing low concentrations of organics.

C. Stainless steel is chemically inert, provides greater structural strength, and its use may be advantageous for large-diameter wells. Teflon casing is chemically inert but is very expensive.

D. Well casing and screen are available in threaded or unthreaded sections and typically in lengths of 5, 10, and 20 feet. Threaded pipe joints may be wrapped with Teflon tape to facilitate joining and to improve the seal. Sections of casing and screen should be assembled onsite to allow inspection immediately before installation. No solvents or adhesive compounds should be used on the threaded PVC or Teflon pipe.

E. Well materials should be cleaned prior to well installation. Two methods are acceptable: high pressure hot water or steam, and detergent wash and distilled rinse. The former is preferred because it is easier and faster. Decontamination procedures are presented in SOP No. 500.

2.1.3 Well Types and Construction Specifications

Well types consist of monitoring and observation wells, recovery wells, and injection wells.

A. Monitoring and Observation Wells

1. An example of a typical monitoring well and observation well is shown in Figure 210-1. The design of the wells consist of a section of slotted well casing or well screen connected to a riser pipe that extends above the ground surface. Typically, a filter pack is placed in the annular space between the screen and the borehole wall. A 2-foot seal composed of hydrated bentonite pellets/chips is placed on top of the filter pack. The remaining height of annulus is sealed and/or grouted to the surface with a

cement, bentonite/cement, or high solid bentonite grout. A lockable protective casing is constructed over the stick-up portion of the wells.

2. The diameter of the borehole and the inside diameter of any drill casing or hollow stem auger should be at least 3 inches greater than the outside diameter of the well casing and screen. This annular clearance facilitates the placement of the filter pack and grout around the outside of the well screen and casing.

3. The monitoring well screens are installed at the level of the water table, typically 15 feet long to adequately monitor seasonal fluctuation of the water table.

B. Recovery Wells

1. An example of a recovery well is shown in Figure 210-2. The design of the well consists of a section of slotted well casing or well screen connected to a riser pipe that extends above the ground surface. Typically, a filter pack is placed in the annulus between the screen and the borehole. A 2-foot seal composed of hydrated bentonite pellets/chips is placed on top of the filter pack. The remaining height of annulus is sealed and/or grouted to the surface with a cement or bentonite/cement grout. A lockable protective casing is constructed over the stick-up portion of the well.

2. The diameter of the borehole and the inside diameter of any drill casing or hollow stem auger should be at least 3 inches greater than the outside diameter of the well casing and screen. This annular clearance facilitates the placement of the filter pack and grout around the outside of the well screen and casing.

3. The recovery well screens are installed at the level of the water table, typically 15 feet long to adequately monitor seasonal fluctuation of the water table.

C. Injection Wells

1. A typical injection well is shown in Figure 210-3. The design of the well consists of a section of slotted well casing or well screen connected to a riser pipe that extends above the ground surface. Typically, a filter pack is placed in the annulus between the screen and the borehole. A 2-foot seal composed of hydrated bentonite pellets/chips is placed on top of the filter pack. The remaining height of annulus is sealed and/or grouted to the surface with a cement or bentonite/cement grout. A

lockable protective casing is constructed over the stick-up portion of the well.

2. The diameter of the borehole and the inside diameter of any drill casing or hollow stem auger should be at least 3 inches greater than the outside diameter of the well casing and screen. This annular clearance facilitates the placement of the filter pack and grout around the outside of the well screen and casing.

3. The injection well screens are installed at the level of the water table, typically 15 feet long to adequately monitor seasonal fluctuation of the water table.

2.2 BOREHOLE ADVANCEMENT

2.2.1 General

A. Boreholes used to install wells should be drilled with the following objectives:

   1. To provide geological data on subsurface conditions, namely stratigraphy, occurrence of groundwater, and depth to bedrock.

   2. To obtain representative disturbed or undisturbed samples for identification and laboratory testing.

   3. To install wells.

B. Prior to drilling, the following steps must be taken:

   1. Obtain permits from the appropriate state agency or agencies. There is a fee for permits, and drilling subcontractors usually include this as part of their fee.

   2. Notify (verbally or in writing) the appropriate state (and federal, if required) authorities in advance of the date that drilling is scheduled to begin.

   3. Check for buried utility lines at all planned drilling locations. For reasons of safety and liability, no drill hole should be advanced if this step has not been completed.

   4. Prepare and implement an approved Site Health and Safety Plan, adhering to all of its provisions for protection of the field crew.

   5. Make provisions for disposal of all cuttings and discharge water in accordance with regulations. Permits may be required.

6. A qualified field geologist/hydrogeologist should be present onsite during drilling.

2.2.2 Selection of Drilling Method

A. Drilling methods should generally be limited to augering or rotary methods using water- or air-based drilling fluids.

B. Drilling methods should be selected based on the following general factors:

1. The expected nature of the subsurface materials to be encountered in the boring.

2. Site accessibility, considering the size, clearance, and mobility of the drilling equipment.

3. Availability of drilling water and the acceptability of drilling fluids in the well.

4. Diameter and depth of the well desired, including consideration of the need to set casing to prevent commingling of different transmissive zones.

5. The nature and effects of contaminations expected during the drilling.

C. It should be recognized that many factors must be considered when deciding which drilling methods are most appropriate at a site under specific conditions. The factors which are related to hazardous waste investigation concerns for the drilling methods are summarized in Table 210-1. Advantages and disadvantages of each technique are identified therein.

2.3 MONITORING WELL INSTALLATION

2.3.1 Well Components

A. Typical well components in general order of placement are as follows:

1. Surface casing (if used)
2. Well casing
3. Screen(s)
4. Filter pack (gravel or sand pack)
5. Bentonite seal
6. Annular seal (grout)
7. Well head protector casing

8. Well head apron and guard posts

B. Surface casing, if needed, should be installed during borehole advancement for the purpose of sealing the ground surface and subsurface transmissive zones not desired to be intercepted by the well from the borehole. Surface casing may also be needed to provide lateral support for loose unconsolidated formations which may slough into or collapse around the borehole during drilling or well installation. Casing may be extended in a telescopic fashion to permit casing through intermittent transmissive zones at greater depths to limit casing size and cost requirements.

C. Screens are perforated or slotted sections of casing typically of the same size and material as the well casing. The purpose of the well screen is to allow water and/or other fluids (i.e product) to enter the well easily while preventing entry of large amounts of sediment. The slot size of the well screen is usually determined based on selection of the filter pack material. Both are commonly related to the grain size analysis of the formation material. Methods of determining appropriate screen slot size are listed in the EPA Manual of Water Well Construction Practices. Typically, 10-slot (0.010 inch slot width) or 20-slot (0.020 inch slot width) screens are used. The length of the screen depends on the sampling objective, water level fluctuations, product thickness, and thickness of the transmissive zone of the formation.

D. The well casing is the primary conduit to the desired borehole interval to be monitored. It serves to seal off other stratigraphic zones from the groundwater inside the well and provides unobstructed access to the well screens. The well casing extends from the top of the well screen to either above or flush with the ground surface. It is typically a single-walled pipe, flush threaded, of the smallest diameter to facilitate sampling equipment and to support its own weight during installation.

E. A filter pack consisting of clean silica sand or pea gravel is placed in the annular space extending to at least 2 feet above the top of the screen. The filter pack will stabilize the aquifer formation, minimize the entry of fine-grained material into the screen, permit use of screens with different sizes of slot, and will increase the effective well diameter and water collection zone.

F. A bentonite seal consisting of pellets or chips should be installed above the filter pack to more effectively seal the well's water collection zone and to prevent the intrusion of overlying grout material into the filter pack. The bentonite pellets or chips should be slowly poured from the top of the borehole to prevent bridging. At least 3 feet of bentonite seal should be placed on top of the filter pack. If the bentonite seal is above the saturated zone, the bentonite pellets or chips should be hydrated with distilled water before grouting the remaining annular space. The hydrated pellets or chips should be allowed to set for a minimum of 15 minutes. Bentonite chips are preferred over pellets or balls when the seal is below the water table because the chips hydrate less rapidly and bridging is less common.

H. The annular space above the bentonite seal should be grouted with a cement, high-solids bentonite, or bentonite/cement grout up to 2 feet below the ground surface. The primary purpose of grouting is to minimize the vertical migration of water to the groundwater intake zone and to increase the integrity of the well casing. Grout design and installation is presented in SOP No. 211.

I. A 2 feet concrete plug should be installed above the annular grout. The concrete plug is used to set the protective well cover and to prevent frost heave of the concrete pad or apron. The concrete apron should be at least 3.5 inch thick and it should be sloped to allow water drainage away from the well.

J. A protective cover with a locking cap should be installed after the well has been set. This cover will protect the exposed well casing from damage and will provide security against tampering with the well. The protective cover typically consists of a steel pipe or box around the well casing. The protective cover is set at least 2 feet into the concrete plug and well-head apron. Weep holes (approximately ¼-inch diameter) are drilled into the base of the protective cover above the concrete apron to allow drainage.

K. Well-head aprons and guard posts, when used, provide additional surface protection to the well and are generally used for wells in high traffic areas or where a more permanent structure is desired.

2.3.2 Installation Procedures

A. Upon completion of the boring and subsurface sampling, it should be decided if a well will be installed. If the borehole diameter is not sufficient to install a well, the borehole should either be reamed using a larger diameter auger or a new borehole should be drilled. The new borehole should be at least 5 feet away from the initial boring. The initial soil boring will be grouted according to the procedures outlined in SOP No. 211.

B. If a well is not installed, the boring should be grouted in accordance with SOP No. 211.

C. Over-drilling should generally not be conducted to provide room for a well sump or additional filter pack material at the bottom of the borehole beneath the well casing. However, for wash rotary boreholes drilled in soft or highly plastic sediments, loose cuttings may fall to the borehole bottom after backwashing. In this case, it may be necessary to install a 2-foot layer of sand or gravel at the bottom of the boring to provide a firm base on which to set the well assembly to limit settling of the well casing and screen under its own weight.

D. For mud rotary boreholes, excess drilling fluids should be flushed from the borehole prior to installing the filter pack and grout seal. This can be accomplished by one or both of the following means:

1. Flush the well using the drilling equipment by pumping clean water down the drill pipe without circulating the returned fluid. This should be accomplished at low pump pressure and with care to avoid scouring or fracturing of the formations.

2. Insert casing and screens with a backwash valve on the bottom end, then flush the borehole via the well casing at low pressures. The backwash valve not only provides an outlet for flushing, but provides pressure relief so the screens are not damaged by the backwash fluid pressures.

The latter method should only be conducted if it is determined that the former is not possible, or if the drilling fluid must remain in place in order to install the filter pack.

E. Connect the screen and well casing while wearing latex gloves. Insert and lower the screen and well casing into the borehole in 10-foot increments. Hand tighten connections to prevent them from leaking or becoming loose.

F. The final section of pipe should be measured and field cut, if necessary, prior to connecting to allow for a stick-up of 2½ feet. The cut end should be rasped and/or sanded smooth, taking care not to let fillings of casing material cling to the inside.

G. Backwash boring, if necessary, and pour in sand or gravel to seat and support the casing and screen. Based on boring and casing diameters, determine volume of filter pack material required to place the filter approximately 2 feet above the top of the screens. Install filter pack using the following methods, as appropriate.

1. Slowly pour filter material down annulus, being careful to evenly distribute the material around the casing and to avoid the material becoming packed between the sidewall and casing. Use a small diameter pipe to dislodge packed material and to ensure adequate height and settlement of the filter pack.

2. Pour filter material down tremie pipe placed between boring sidewall and casing. In this method, clean potable or distilled water should be poured in along with the sand or gravel to prevent packing within the tremie. The bottom of the tremie should be kept above the filter material top by at least 5 feet to permit the filter material to evenly fall around the screens. Pack the material with the tremie pipe to ensure adequate height and settlement of the filter pack.

H. Pour bentonite pellets or chips down the annulus on top of the filter pack. The bentonite should be placed rapidly to prevent swelling and bridging around the casing when it hydrates. The bentonite should be allowed to hydrate for at least 15 minutes prior to grouting.

I. The remaining annulus should be sealed by pumping grout via a tremie pipe from the bottom of the annular space of the borehole until the grout returns to the surface displacing all remaining drilling fluid and formation water. The bottom of the tremie pipe should not be placed within four (4) feet of the bentonite seal. Grouting mixture and technique should be in accordance with SOP No. 211. Grout will typically settle 1 to 2 feet. Remove excess grout to allow 2 feet of annular space for the concrete plug.

J. After the grout has stiffened sufficiently, install the concrete plug up to the ground surface. Set the protective cover, if possible, such that at least 2 feet of its length is embedded in the concrete below the ground surface. It should also be set such that it is not more than approximately 30 to 36 inches above the level of which the sampling personnel must stand. A concrete pad approximately 3 feet in diameter and 3.5 feet thick should be formed around the base of the protective cover. The concrete pad should be sloped away from the protective cover to allow flow away from the well. Weep holes should be drilled through the protective cover nominally 1 inch above the top of the concrete apron.

K. The protective casing should be marked with identifying decals. A locking device should be installed to prevent unauthorized entry or vandalism of the well.

L. The top of the well casing should be notched with a file to provide a reference point in which to measure water and/or product levels. The elevation of the top of the well casing (reference point) and ground surface at the well should be surveyed relative to a USGS benchmark. The location of the well should also be surveyed in reference to the site coordinate system.

M. Develop well within 24 to 72 hours following well installation according to the well development procedures outlined in SOP No. 212.

3.0 DOCUMENTATION

A. Documentation of well installation should be the responsibility of the supervising geologist/hydrogeologist. A well completion report should be prepared after the well is installed. An example of a Well Completion Report is provided in Attachment 1.

B. The drilling and well installation activities should be recorded in the field logbook or on appropriate forms. The following minimum information should be recorded during and upon completion of every well installation.

1. Project name and number.
2. Well location identification.
3. Date of installation and time completed.
4. Drilling methods, crew names, and rig identification.
5. Drilling depths.
6. Generalized subsurface stratigraphy.
7. Total length of casing and screens.
8. Depth to water and/or product.
9. Depth to and length of screened intervals.
10. Depth to top of filter pack.
11. Depth to top of annular seal.
12. Depth to top of bentonite seal.
13. Depth to top of grout.
14. Depth of surface casing (if necessary).
15. Elevation of top of well casing and ground surface.
16. Name and signature of supervising geologist/hydrogeologist.

C. The licensed driller should also prepare any state-required well completion forms in accordance with the state regulatory requirements. An example form is provided in Attachment 2.

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MONITORING WELL COMPLETION REPORT

PROJECT NAME: ____________________ WELL NO.: ____________________

PROJECT NUMBER: ____________________ GEOLOGIST: ____________________

INSTALLATION DATE: ____________________ DRILLING CO.: ____________________

BOREHOLE O.D.: ____________________ DRILLER: ____________________

TOTAL SCREEN & RISER LENGTH (FT): __________ RIG TYPE: ____________________

TOP OF CASING ELEVATION __________ FT

SURFACE ELEVATION __________ FT

TOP OF GROUT __________ FT BGS

TOP OF BENTONITE SEAL __________ FT BGS

TOP OF FILTER COLLAR SAND __________ FT BGS

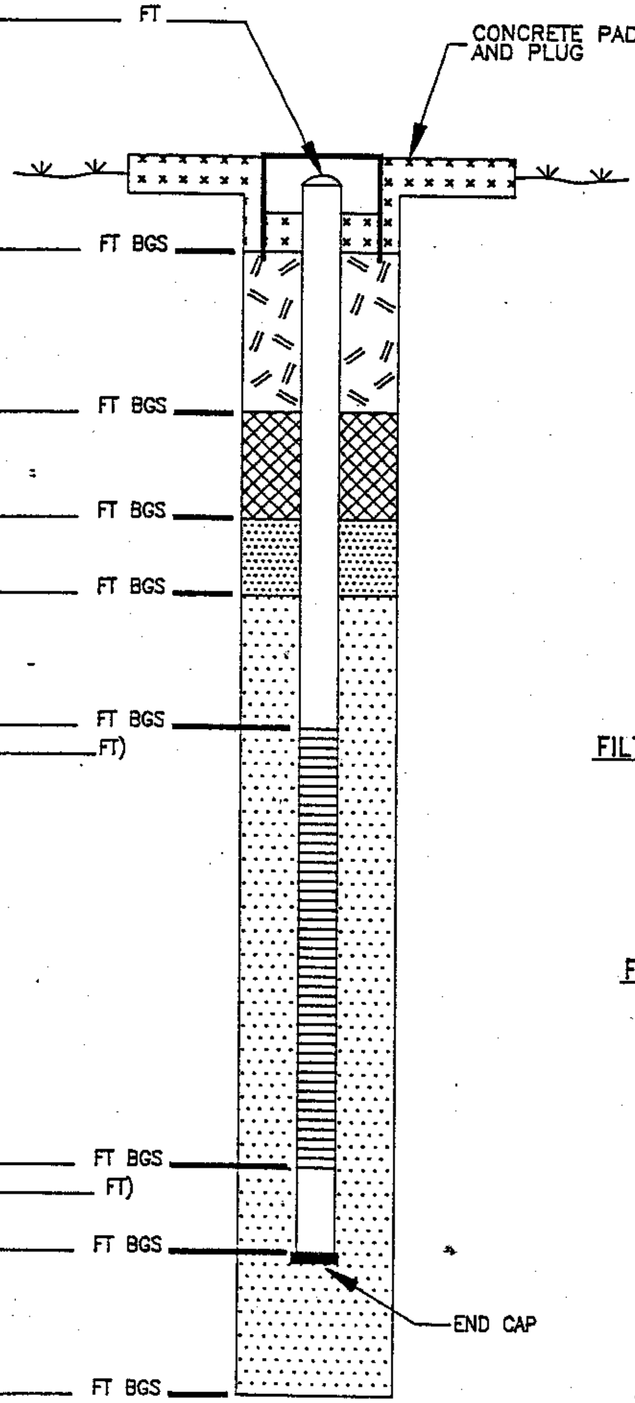
TOP OF FILTER PACK SAND __________ FT BGS

TOP OF SCREEN __________ FT BGS
(ELEVATION __________ FT)

BASE OF SCREEN __________ FT BGS
(ELEVATION __________ FT)

BASE OF SUMP __________ FT BGS

TOTAL BORING DEPTH __________ FT BGS



WELL CAP
TYPE OF MATERIAL: __________
(SLIP/THREADED/LOCKING): __________
LOCKING (Y/N): __________

WELL RISER
TYPE: __________
TYPE: __________
SCHEDULE: __________
I.D.: __________
LENGTH: __________
THREAD TYPE: __________
CENTRALIZERS (Y/N): __________

GROUT MIXTURE/ HIGH SOLIDS BENTONITE
CEMENT TYPE: __________
CEMENT (BAGS): __________
BENTONITE TYPE: __________
BENTONITE (BAGS): __________
WATER (GAL): __________
TREMIE PIPE (Y/N): __________

BENTONITE SEAL
TYPE: __________
BRAND NAME: __________
QUANTITY: __________
HYDRATED (Y/N): __________
TREMIE PIPE (Y/N): __________

FILTER COLLAR SAND
BRAND NAME: __________
TYPE: __________
SIZE: __________
NUMBER OF BAGS: __________
TREMIE PIPE (Y/N): __________

FILTER PACK SAND
BRAND NAME: __________
TYPE: __________
SIZE: __________
NUMBER OF BAGS: __________
TREMIE PIPE (Y/N): __________

WELL SCREEN
TYPE: __________
SCHEDULE: __________
I.D.: __________
LENGTH: __________
THREAD TYPE: __________
SLOT SIZE: __________
CENTRALIZERS (Y/N): __________

END CAP
TYPE OF MATERIAL: __________
(SLIP/THREADED): __________

NOTE: BGS = BELOW GROUND SURFACE
AGS = ABOVE GROUND SURFACE

REV. 6-26-96 CAD NO. MONWELL

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GROUP SERVICES

APPENDIX L-4

WELL DEVELOPMENT

WELL DEVELOPMENT

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 212 describes the guidelines for developing wells as described in the Work Plan, Field Operations Plan (FOP), or as otherwise specified. Well development is conducted to remove drilling fluids or mudcake from the filter pack, borehole wall, and formation materials to enhance the flow of groundwater and/or product into the well. Well development removes any loose formation materials (i.e., fine sand and silt) from the filter pack that may impact the integrity of groundwater and/or product samples.

2.0 EXECUTION

2.1 GENERAL REQUIREMENTS AND CONSIDERATIONS

A. Well development shall be conducted for all wells for the following reasons:

1. To restore the natural permeability of the formation adjacent to the borehole.

2. To remove clay, silty and other fines from the filter pack and well screen so that water and/or product samples will not be abnormally turbid or contain undue suspended matter.

3. To remove remnant drilling fluids and other contaminants from the well, filter pack, and formation material introduced during drilling.

B. All equipment, including pumps, hoses, containers, and bailers should be decontaminated prior to and after introduction into wells to be developed. Decontamination should be followed in accordance with SOP No. 500.

C. Personnel involved in well development procedures shall follow the prescribed Site Health and Safety Plan (SHSP).

2.2 DEVELOPMENT METHODS

2.2.1 Air Lifting

A. The air lift method involves pumping compressed air down an eductor pipe placed inside the well casing. Due to its inert characteristic, nitrogen is the preferred gas for air lifting. The use of standard air for well development may impact permeability of the formation surrounding the well screen and groundwater quality.

B. Pressure applied intermittently and for short periods causes the water to surge up and down inside the casing. Once the desired surging is accomplished, continuously applied air pressure should be used to blow water and suspended sediments upward and out of the well.

C. Considerable care must be exercised to avoid injecting air directly through the well screen. Air can become trapped in the formation materials outside the well screen and affect subsequent chemical analyses of water samples and hydraulic conductivity measurements. The bottom of the air pipe should not be placed below the top of the screened section of casing.

D. Another restriction of the use of air is the submergence factor. The submergence factor is defined as the height of the water column above the bottom of the air pipe (in feet) divided by the total length of the air pipe. To result in efficient air lift operation, the submergence factor should be at least 20 percent. This may be difficult to achieve in shallow monitoring wells or wells which contain small volumes of water.

2.2.2 Surge or Plunging

A. A surge block is a round plunger with pliable edges (constructed of a material such as rubber belting) that will not catch on the well screen. Moving the surge block forcefully up and down inside the well screen causes the water to surge in and out through the screen accomplishing the desired cleaning action. Close monitoring of the amount of pressure generated must be made to prevent cracking of the well casing or screen.

B. A well slug may also be used to create a surging effect through the filter pack and formation. A slug consists of a PVC rod or pipe (with capped ends) sufficiently weighted to rapidly sink in water. The slug is alternately lowered into and retrieved from the water in the casing to create a water level differential that induces flow into or out of the well to accomplish the desired cleaning action. This method is less aggressive than using a surge block.

C. For shallow wells or wells in which the water column in the casing is small, care must be exercised when lowering the slug so as not to drive the slug into the bottom of the casing or against the screens.

2.2.3 Bailing and Pumping

A. A bailer which is heavy enough to sink rapidly through the water can be raised and lowered through the water column to produce the surging action that is similar to that caused by a surge block or well slug. The bailer, however, has the added capability of removing turbid water and fines each time it is brought to the surface. Bailers are very useful for developing shallow and slow yielding wells. As with surge blocks, it is possible to produce pressure great enough to crack PVC casing. Bailers are the simplest and least costly method of developing a well, but are time consuming.

B. Pumping can be used effectively in wells where recharge is rapid. The type and size of the pump used is contingent upon the well design. Pumps also allow removal of turbid water and fines. However, pumps are more difficult to decontaminate than a bailer.

3.0 PROCEDURES

A. Measure the depth to groundwater in accordance with the guidelines in SOP No. 220 and calculate the standing water volume in the well to be developed. The standing well volume (V) is calculated using the following formula:

$$V = nA\,(B-C) + CD$$

where,

n = porosity of the filter pack
A = height (in feet) of the saturated filter pack
B = volume (in gallons per foot) of water in the borehole
C = volume (in gallons per foot) of water in the well casing
D = height of the standing water column (in feet) in the well

The height of the standing water column is calculated by subtracting the static water level from the total depth of the well. The volume of water in the well and borehole will vary with diameter.

B. The data collected during development should be recorded on the well development/groundwater sampling form as outlined in SOP No. 110. An example of this form is provided in Attachment 1.

C. Water quality parameters will be measured prior to and during well development. The water quality parameters should include pH, specific conductance, dissolved oxygen, temperature, and relative turbidity. Turbidity of the groundwater (including the presence of oil droplets, oil sheen, and hydrocarbon odors) should be noted if observed. The field measurements of the groundwater quality parameters should be performed in accordance with the guidelines in SOP No. 320.

D. Water quality parameters will be measured after each well volume is removed. The data will be recorded on the field activity form and/or field logbook.

E. The well will be developed for a minimum of 10 well volumes and until the water quality parameters stabilize. The criteria for parameter stability is summarized below:

1.	pH:	+ or − 0.1 unit
2.	conductivity:	+ or − 15%
3.	dissolved oxygen:	+ or − 15%
4.	temperature:	+ or − 0.5° C

F. Development water should be contained in 55-gallon drums and disposed onsite in accordance with the FOP.

G. Appropriate personal protection should be used when encountering product or strong product odors that exceed the action levels specified in the SHSP.

4.0 DOCUMENTATION

A. Well development activities should be documented in the field logbook, describing the procedures used and any significant occurrences that are observed during development such as apparent recharge rates in the well, condition of the groundwater, and organic vapor readings. Well development data including the depth to static water, standing water volume in the well, total volume of water removed, number of well volumes removed, and water quality parameters should be recorded on the field activity form (Attachment 1).

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APPENDIX L-5

BOREHOLE LOGGING AND MATERIAL CLASSIFICATION

BORHOLE LOGGING AND MATERIAL CLASSIFICATION

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 120 describes the guidelines for logging and classifying soil samples and rock cores during drilling and sampling operations as described in the Work Plan, Field Operations Plan (FOP), or as otherwise specified for the purpose of characterizing subsurface geologic conditions at the sampling site.

2.0 EXECUTION

2.1 GENERAL REQUIREMENTS

A. Geologic logging and/or material classification will be conducted for all subsurface and surface soil sampling and rock coring activities based on the following:

1. Visual observation of recovered samples.

2. Examination of drill cuttings.

3. Driller's observations of drilling rig behavior between sample intervals and during coring.

4. Identification of the location of groundwater.

5. Results of downhole tests (e.g., Standard Penetration Test).

B. Geologic logging and material classification shall be conducted only by a qualified geologist or a hydrogeologist or by a trained logging technician under the supervision of a geologist or a hydrogeologist.

C. Subsurface soil sampling and rock coring will be conducted in accordance with the guidelines specified in SOP No. 200.

D. Borehole materials may contain hazardous constituents, and the logging personnel should use caution when extruding and examining samples to prevent exposure. Air monitoring, use of personal protective equipment, and other safety practices while logging will be in accordance with the approved Site Health and Safety Plan (SHSP).

E. Tools and equipment used while logging boreholes shall be decontaminated between boring locations and prior to each sampling events in accordance with the requirements of the QAPP and SOP No. 500.

F. Field data and observations associated with borehole logging shall be documented during logging and for all drilling and sampling activities in accordance with SOP No. 110, if not otherwise specified herein. All field drilling activities should be recorded in a field logbook; boring log forms (Attachment 1) should be used to allow for added detail and organization of field data.

2.2 LOGGING EQUIPMENT AND SUPPLIES

The geologist/hydrogeologist should maintain a collection of logging equipment and supplies needed for sample handling and logging. The equipment and supplies generally used, but not limited to, are listed below.

- Soil Sampling and Logging Equipment and Supplies:
  - stainless-steel butcher knife
  - aluminum foil
  - paper towels
  - slim, stainless-steel spatulas or icing spreaders
  - ruler, tape measure (in 0.01-inch increments)
  - color chart
  - appropriate sample containers and lids
  - logbook and field document forms (as required)
- Rock Coring and Logging Equipment and Supplies:
  - tape measure (in 0.01-inch increments)
  - comparative charts for grain size, sphericity, and percentages of silt, clay, and sand
  - hand lens
  - pens (indelible ink)
  - core box(es)

- Other Supplies:

  - camera
  - 5-gallon plastic buckets and wire brushes
  - decontamination fluids and supplies
  - vinyl surgical gloves
  - plastic bags
  - distilled water
  - personal protective equipment, if necessary

2.3 LOGGING AND DOCUMENTATION

A. The geologist/hydrogeologist shall record all pertinent drilling information on the boring log forms (Attachment 1). The following technical information shall be recorded, as a minimum:

1. Project name and number.
2. Location (well or boring number) or other sample station identification, including a rough sketch.
3. Name of geologist or hydrogeologist overseeing the drilling operation.
4. Approximate ground elevation based on topographic map information.
5. Well installation or boring date.
6. Drilling contractor, type of rig, personnel, and equipment.
7. Drilling method and fluid used.
8. Drilling fluid gain or loss.
9. Depth of fluid losses.
10. Problems with drilling rig.
11. Water levels encountered during drilling.
12. Presence and depth of petroleum product.

13. Casing type and diameter.

14. Screen type and diameter.

15. Rock and/or soil classification and lithology.

16. Lithologic changes and boundaries.

B. Additionally, when rock coring is performed, the following information shall be recorded:

1. Top and bottom of cored interval.

2. Core length.

3. Coring rate in minutes per foot.

4. Percentage of sample recovered.

5. Core breakage due to discontinuities (natural fractures vs. coring-induced breaks).

6. Total core breakage.

7. Number of breaks per foot.

C. The geologic boring log forms should also include a complete visual lithological description of the soil/rock, description of any tests conducted in the borehole, and/or placement and construction details of wells.

2.4 SOIL SAMPLE CLASSIFICATION AND DESCRIPTIONS

2.4.1 Description of Hierarchy

A. The required order of terms is as follows:

1. Primary soil type followed by gradation modifier, if appropriate.

2. Secondary and tertiary (if needed) soil type modified by "slightly" or "very," if appropriate.

3. Color, if appropriate.

4. Texture.

5. Consistency, relative density, or the degree of cementation.

6. Structure.

7. Moisture content.

8. Trace components, sorting, condition of sample.

9. Contamination, if encountered.

2.4.2 **Soil Types**

A. Soil description and classification shall be in accordance with the Unified Soils Classification System (ASTM D2488-84). The order and presentation of the terms is as follows:

1. Major soil component – that portion of the soil which is the predominant grain size constituent. Nouns are used and are unabbreviated and capitalized (i.e., CLAY, SILT, SAND, or GRAVEL); "TOPSOIL" is an adequate single term for the naturally occurring organic soil found at the ground surface.

2. Secondary and tertiary (if needed) component greater than 20 percent of total, if present – adjective used (i.e., clayey, silty, sandy, or gravelly).

2.4.3 **Color**

A. The color descriptions should be consistent with the Geological Society of America (GSA) Rock Color Chart. Numerical Munsell notation is acceptable, but a written description is preferred. The major color is listed first with any accessory colors thereafter (e.g., clay, yellow brown with occasional light-green mottles). If secondary or tertiary descriptors are used, the color designation follows each descriptor.

2.4.4 **Consistency and Relative Density**

A. The relative density of cohesionless soils and the consistency of cohesive soils should be included in visual classifications. Attachment 2 can be used in describing the consistency of cohesive soils, and Attachment 3 can be used in describing the relative density of cohesionless soils.

2.4.5 **Miscellaneous Descriptions**

A. Structure – Some soils possess structural features (e.g., fissures, slickensides, or lenses) and, if so, are described.

B. Moisture Content – Criteria for describing the moisture content of cohesive soils are described in Attachment 4.

C. Accessories or Inclusions – Elements such as rock fragments, fine roots, or nodules are included in the soil description following all other modifiers for the major components of the soil matrix. Any mineralogical or other significant components are described here.

D. Contamination – If monitoring or visual observations indicate the presence of contamination, it should be noted in detail.

E. Descriptors – To provide consistency in logging soils, a summary of descriptor guidelines is provided in Attachment 5.

F. Measurement – All lengths and measurements are recorded in feet and tenths of feet.

2.5 ROCK CLASSIFICATION

2.5.1 Lithology and Texture

A. The geologist/hydrogeologist should describe the lithology of the rock and its mineral composition. The geological name, such as granite, basalt, or sandstone, usually describes the rock's origin.

B. The stratigraphic unit should be identified and assigned the local geological name, if appropriate. Stratigraphic age or period should be identified, if possible.

C. Modifiers should be included to describe rock texture, including grain size, sorting, packing, cementation, etc. (i.e., interlocking, cemented, or laminated-foliated).

2.5.2 Color

A. The color descriptions should be consistent with the Geological Society of America (GSA) Rock Color Chart. Numerical Munsell notation is acceptable. The major color is listed first with any accessory colors thereafter (e.g., shale, bluish-gray with occasional light-green laminae). If secondary or tertiary descriptors are used, the color designation follows each descriptor.

2.5.3 Hardness

A. Terms used to describe hardness are described below. One common method to determine hardness is the Mohs Scale of Hardness defined as follows:

Descriptive Term	Defining Characteristics
Very Hard	Can not be scratched with knife. Does not leave a groove on the rock surface when scratched.
Hard	Difficult to scratch with knife. Leaves a faint groove with sharp edges.
Medium	Can be scratched with knife. Leaves a well-defined groove with sharp edges.
Soft	Easily scratches with knife. Leaves a deep groove with broken edges.
Very Soft	Can be scratched with fingernail.

2.5.4 Weathering

A. Terms used to describe weathering are described below:

Descriptive Term	Defining Characteristics
Fresh	Rock is unstained. May be fractured, but discontinuities are not stained.
Slightly	Rock is unstained. Discontinuities show some staining on the surface, but discoloration does not penetrate rock mass.
Moderate	Discontinuous surfaces are stained. Discoloration may extend into rock mass along discontinuous surfaces.
High	Individual rock fragments are thoroughly stained and can be crushed with pressure of a hammer. Discontinuous surfaces are thoroughly stained and may crumble.
Severe	Rock appears to consist of gravel-sized fragments in a "soil" matrix. Individual fragments are thoroughly discolored and can be broken with fingers.

2.5.5 **Rock Matrix Descriptions**

A. Grain size is a term that describes the fabric of the rock matrix. It is usually described as fine-grained, medium-grained, or coarse-grained. The modified Wentworth scale should be used.

B. A description of bedding (after Ingram, 1954) or fracture joint spacing should be provided according to the following:

Spacing	Bedding	Joints/Fractures
<1 inch	Very thin	Very close
1 inch – 4 inches	Thin	Close
4 inches - 1 foot	Medium	Moderately close
1 foot – 4.5 feet	Thick	Wide
>4.5 feet	Very thick	Very wide

C. Discontinuity descriptions are terms that describe number, depth, and type of natural discontinuities. They also describe density, orientation, staining, planarity, alteration, joint or fracture fillings, and structural features.

2.6 ROCK CORE HANDLING

A. Core samples must be placed into core boxes in the sequence of recovery, with the top of the core placed in the upper left corner of the box. At the bottom of each core run, spacer blocks must be placed to separate the runs. The spacer should be indelibly labeled with the drilling depth to the bottom of the core run; regardless of how much core was actually recovered from the run. Figure 120-1 shows the proper storage and labeling methods.

B. Spacer blocks should be placed in the core box and labeled appropriately to indicate zones of core loss, if known. Where core samples are removed for laboratory testing, blocks equal in length to the core removed are placed in the box. If wooden core boxes are used, spacer blocks should be nailed securely in place.

C. The core boxes for each boring should be consecutively numbered from the top of the boring to the bottom. Core from only one boring should be placed in a core box.

D. The core boxes containing recovered rock cores should be photographed.

E. One core box should be photographed at a time. The box lid is framed in the picture to include information printed on the inside of the lid. Be sure to include a legible scale in the picture. Photographs are most easily and efficiently taken in the field while the core is fresh and with natural light.

F. When transporting a boxed core, the box should be moved only if the lid is closed and secured with tape or nails.

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Boring / Well No.:	Start Date & Time:	Boring Location / Coordinates:
Logged By:	Finish Date & Time :	
Project Name:	Project No.:	N
Project Location:		
Drilling Co.:	Drilling Equipment:	
Driller:	Drilling Method:	
Ground Elevation:	Top of Casing Elevation:	
Borehole Dia.:	Development Method:	
Outer Casing Dia / Material / Length:		
Inner Casing Dia. / Material / Length:		
Screen Interval / Material / Slot size:		
First Water:	Static Water:	
Date:	Date:	
Time (hrs):	Time:	Surface Conditions:

DEPTHS		DESCRIPTION	GRAPHICS	SAMPLE INFORMATION						PID or FID Measurements / Remarks	
Top	Bottom			I.D.	Interval	Recovery	Method	Moisture	Blow Count	Scan	Headspace
0					to						
					to						
					to						
					to						
					to						
					to						
					to						

APPENDIX L-6

GROUNDWATER SAMPLING

Standard Operating Procedure No. 410

GROUNDWATER SAMPLING

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 410 describes the guidelines for obtaining groundwater samples from monitoring wells, recovery wells, or observation wells as described in the RA Work Plan or as otherwise specified for the purpose of determining groundwater quality.

2.0 EXECUTION

2.1 GENERAL REQUIREMENTS

A. Decontaminate all sampling instruments as specified in the SAP and in accordance with SOP No. 500.

B. Provide sufficient quantity and type of sample containers at the groundwater sampling location. Sample bottle sizes, preservation techniques, quantity, and other specifics are outlined in the Quality Assurance Project Plan (QAPP). Sample Classification, storage, packaging, and shipment will be conducted in accordance with SOP No. 911.

C. Field measurements including pH, temperature, and specific conductance of each well volume will be performed prior to sampling. Dissolved oxygen will measured downhole following successful development of the well. Field measurements are discussed in detail in Section 3.4 of the SAP and SOP No. 320.

D. The first water sample collected will be for volatile organic analysis (VOC). The sample vials should be filled with as little agitation as possible as it passes from the sampling device to the sample bottle. There should be no air bubbles present in a VOC sample vial. Other sample bottles can then be filled and preserved as specified in the SAP and QAPP.

E. Trip blank samples that were supplied by the laboratory along with the sample bottles will be used as discussed in SOP No. 920 and the QAPP.

2.2 FIELD MEASUREMENTS

2.2.1 General

A. Measure and record depth to water in wells and calculate standing water volume in the well.

B. Record physical characteristics of the water sample in the field logbook and/or field activity forms. The physical characteristics include color, general turbidity, odor, viscosity, and other observations.

C. Measure and record water quality parameters of the water sample in the field logbook and/or field activity forms. The water quality parameters include:

1. pH
2. temperature
3. specific conductance
4. dissolved oxygen (downhole)

D. Specific conductance and pH measurements are used to determine when the purging process is completed and representative groundwater from the aquifer is present in the well.

E. Due to the nature of most field measurement devices, it is difficult or impossible to decontaminate them thoroughly and so they should not enter the well directly. Therefore, samples for field measurements should be taken from the purged water. Care should be taken not to contaminate the field measurement equipment with material that cannot be safely rinsed off.

F. Field instruments should be calibrated before sampling. Calibration procedures for field instruments should be followed in accordance with SOP No. 930.

2.2.2 Field Measurement Procedures

The following field measurements should be performed and noted in the bound field logbook and/or field activity form:

A. Physical Measurements

1. Well number and location
2. Diameter and construction material of the well casing.
3. Total depth of well from the top of casing (TOC), surveyor's mark, if present.
4. Depth from top of casing to water (DTW).
5. Calculate the linear feet of water in the well/borehole by subtracting depth to water from total depth of well/borehole. The capacity of various well casing/borehole diameters are as follows:

Casing or Borehole Diameter	Gallons/Linear Ft.
2"	0.16
4"	0.66
6"	1.47
8"	2.61
12"	5.81

Now calculate the standing water volume (V) present in the well casing and filter pack as follows:

$$V = nA(B-C) + CD$$

where,

n = porosity of the filter pack (usually 0.25)
A = height (in feet) of the saturated filter pack
B = volume of water in the borehole (gallons)
C = volume of water in the well casing (gallons)
D = height (in feet) of the standing water column in the well

B. Water Quality Parameters

In addition to the physical measurements described above and other information that may identify the well, record the following water quality parameters for each well volume removed prior to sampling:

1. pH
2. temperature
3. specific conductance
4. dissolved oxygen

2.3 WELL PURGING AND EVACUATION PROCEDURES

2.3.1 General

A. In order to obtain a representative groundwater sample, the water that has stagnated and/or thermally stratified in the well casing should be purged or evacuated. This evacuation procedure allows fresh or formation groundwater to enter the well. A minimum of three well volumes should be evacuated or until the water quality parameters stabilize in high yield wells. In wells with very low recoveries, the well may be evacuated to near dryness and allowed to recover prior to sampling.

B. Criteria for parameter stabilization include:

1. pH, ± 0.1 unit
2. temperature, ± 0.5° C
3. conductivity, ± 10%

C. All newly constructed wells should be allowed to stabilize for a minimum of 48-72 hours prior to sampling. Additionally, once a well is evacuated, it should be sampled within 2 hours. If an evacuated well is allowed to sit longer than the prescribed 2 hours, it should be re-evacuated as the water contained in the well casing may no longer be representative of aquifer conditions.

2.3.2 Evacuation by Pumping

A. Extreme caution should be exercised to ensure that this evacuation procedure does not cause cross-contamination from one well to the next. Therefore, dedicated tubing and pumps are preferred. If it is not practical to dedicate a pump to a specific well, it is permissible to decontaminate this equipment. The pump may be reused to sample monitoring wells installed at the same waste handling unit. Equipment should be decontaminated in accordance with SOP No. 500. Tubing should always be dedicated and never used for more than one well. Wash and rinse the pump and collect a sample of the rinse water as a field blank to ensure the integrity of the sample.

B. During evacuation, set the pump intake not greater than 6 feet below the dynamic water level in the well. This requires that the evacuation device may have to be lowered as purging continues.

C. During pumping, intermittently collect pump discharge in a container of known volume for a period of not less than 2 minutes to verify the pump flow rate and to check the purged volume.

D. Measure the temperature, conductivity, and pH after each required well casing volume and intermittently thereafter until field measurements are consistent within a 10 percent variance.

E. Collect purged well water in drums, buckets or suitably sized containers for subsequent disposal as specified in the RP&S.

2.3.3 **Evacuation by Bailing**

A. Hand bailing should be utilized when static water levels are greater than 25-feet or if no submersible pump is available. However, care should be exercised to prevent introduction of contaminants into the well and causing excessive aeration of the water sample.

B. For dedicated bailers, wash and rinse the bailer before purging if contaminants, foreign matter, or rust are present. For non-dedicated bailers used at more than one well, decontaminate the bailer in accordance with SOP No. 500.

C. Evacuate a minimum of three well volumes by repetitive bailing and until water quality parameters stabilize.

D. Collect purge water in 55-gallon drums or as specified in the RP&S.

2.4 SAMPLING EQUIPMENT

Equipment to be utilized for groundwater sampling generally falls into two categories; those used to evacuate the well casing and those used to collect a discrete sample for analysis. In some instances, the device utilized for evacuation may also be used for sample collection. In many instances, however, characteristics exhibited by the evacuation device may preclude its use for sample collection. Types of equipment available for evacuation and/or sampling include the following:

1. Bottom fill bailers
   a. single check valve (bottom)
   b. double check valve (top and bottom)
   c. polyethylene, polypropylene, PVC, or Viton® construction
   d. Teflon construction
   e. stainless-steel construction
   f. stainless-steel construction with Teflon check valve(s)

2. Suction lift pumps/centrifugal pumps

3. Portable submersible pumps

4. Bladder (gas squeeze) pumps

5. Continuous organics sampling system in conjunction with peristaltic pump

Hand bailers come in a variety of sizes and volumes to accommodate most well casing diameters. The preferable materials of construction are, in order of decreasing preference, Teflon, stainless steel, polypropylene, polyethylene, Viton®, PVC (low plasticizer content).

In addition to an evacuation and sampling device, other pieces of equipment and supplies necessary for sampling include:

1. Steel tape and chalk or electronic water level indicator

2. Sample containers

3. Preservatives, as needed

4. Ice or ice packs

5. Field instrumentation, as needed

6. Trip blanks

7. Bound field logbook

8. Sample analysis request forms

9. Chain of custody forms and custody seals

10. Sample labels, indelible

11. Appropriate personal protective equipment

12. Appropriate hand tools

13. Keys to locked wells, if needed

14. Water filtration device and disposable filters, if necessary

Field equipment for sampling, evacuation, and field measurements should be as specified in the SAP.

2.5 SAMPLING METHODS

2.5.1 **Bottom-fill Bailer**

A. After evacuation of the required volume of water from the well, proceed with sampling as soon as possible after evacuation, preferable immediately. In most cases, the time lapse between evacuation and sampling should not exceed 2 hours.

B. The type of bailer used for sampling will depend on the required quality of gathered information.

C. The bailer and any other equipment entering the well should be properly decontaminated and handled with new surgical gloves to preclude any potential contamination sources. Nothing entering the well should be allowed to contact the ground or any other potentially contaminated surfaces, (i.e., gasoline pumps). If this should occur, that item should not be placed in the well or utilized for sampling. It is always a good practice to have an extra clean bailer on hand in the case of an emergency. Plastic sheeting should also be placed around the well to preclude any contact of equipment with the ground surface.

D. Lower the bailer by hand using either a stainless-steel cable or a new length of nylon rope. Hand bailers should be lowered into the well using caution not to aerate the well water to be sampled. Lower the bailer to the well screen interval and pull the rope up. Retrieve the bailer and slowly transfer the sample to the appropriate sample containers, filling VOC vials first. If onsite filtration is required, extra quantities of sample should be collected.

2.5.2 Suction Lift Pumps/Centrifugal Pumps

A. Suction lift pumps (i.e., diaphragm, peristaltic, and centrifugal) are pumps utilized at the ground surface with polyethylene tubing inserted into the well. They are used to evacuate the well, prior to sampling. The tubing should be new and dedicated to a particular monitoring well, and equipped with a valve which will prevent the aerated water to fall back into the well. The pump casing should be rinsed with tap then distilled water between sampling points.

B. The limitation posed by this type of pump is its suction capability. Generally, the groundwater level should be less than 25-feet below the ground surface.

C. Due to the nature of these pumps, as well as their effect upon samples for chemical analysis, these devices should only be utilized for well evacuation and not groundwater sampling unless otherwise specified in the SAP.

2.5.3 Portable Submersible Pumps

A. When the groundwater level is greater than 25-feet, the use of suction lift pumps is prohibited and another evacuation device should be used. If the diameter of the well casing allows, a portable submersible pump can be utilized. Due to the nature of these pumps, as well as their effect upon samples for chemical analysis, these devices should only be utilized for monitoring well evacuation and not groundwater sampling unless otherwise specified in the RP&S.

2.5.4 Bladder Pumps (Gas Squeeze Pumps)

A. A bladder pump consists of a stainless-steel housing that encloses a flexible membrane. Below the bladder, a screen is attached to filter any material that may clog the check valves that are located above and below the bladder. The pump works as follows: waters enters the membrane through the lower check valve; compressed gas is injected into the cavity between the housing and bladder. The water moves through the upper check valve and into the discharge line. This upper check valve prevents back flow into the bladder.

B. The bladder pump is utilized much like the portable submersible pump, except that no electrical lines are lowered down the well. The source of gas for the bladder is either bottled air or an onsite air compressor. Disadvantages include the large gas volumes needed, potential bladder rupture, and difficulty in cleaning the unit.

C. The pumps <u>can not</u> be used to collect samples for VOC analysis due to the pressure gradients to which the sample is exposed but are otherwise suitable for sampling.

2.5.5 Potable Well Sampling Procedure

A. The first step in sampling a potable well, whether it be a homeowner's well or a municipal production well, is to obtain as much information as possible from the homeowner or water superintendent. This should include: depth of the well, formation in which it is completed, screen depth and length, diameter of casing, and when and who installed it. Caution should be utilized in applying this information unless confirmation can be obtained (i.e, drilling logs).

B. With this information, determine the number of gallons to be evacuated. If no information is available, evacuate for a minimum of 15 minutes. This evacuation is best accomplished from an outside faucet with a hose run away from the home. In this manner, overloading of the homeowner's septic system will be minimized.

C. An inspection of the system should be performed to locate the well, pump, storage tanks, and any treatment systems that may be present. The sample access point should be chosen as close to the well head as possible, prior to the storage tank or any treatment devices. Collect that sample at the first tap or spigot and note in the field log book where the sample was collected, and any systems (storage and/or treatment) between the well head and sample collection point. For long-term monitoring projects, a specific tap or faucet could be designated as the sample access point and utilized for the duration of the project.

3.0 SAMPLE HANDLING

A. Groundwater samples should be placed in appropriate sample containers and preserved in accordance with SOP No. 910 and the QAPP.

B. Groundwater samples should be classified, stored, packaged, and shipped in accordance with SOP No. 911 and the QAPP.

C. Sample control and chain of custody protocol should be following in accordance with SOP No. 912 and the QAPP.

4.0 DOCUMENTATION

A. The location of the well, physical characteristics, well evacuation volume, and water quality parameter measurements should be recorded on the groundwater sampling form (see Attachment 1) and/or the field logbook. Documentation procedures should be in accordance with SOP No. 110.

ATTACHMENT 1

Standard Operating Procedure No. 410
Well Development and/or Groundwater Sampling Form

WELL DEVELOPMENT AND/OR GROUNDWATER SAMPLING DATA

PROJECT INFORMATION		DEVELOPMENT/PURGE METHOD	
PROJECT NAME	WELL ID	METHOD	
PROJECT NO.	GEOLOGIST/ENGINEER	PUMP MAKE, SIZE, AND TYPE	
DEVELOPMENT/PURGING-SAMPLING	CONTRACTOR	PUMP INTAKE DEPTH	
EVENT	RIG TYPE	PUMP RATE	PUMP ELAPSED TIME
START DATE	END DATE	METHOD TO OBTAIN PUMP RATE	

DEPTH MEASUREMENTS	INITIAL		FINAL	
Note: Depth feet BTOC	Depth	Time	Depth	Time
PRODUCT				
GROUNDWATER				
SEDIMENT				
CASING BASE				

VOLUME PRODUCTION INFORMATION	
CASING ID	LINEAR FEET OF WATER
VOLUME TYPE	ONE VOLUME
TOTAL VOLUME OF WATER PRODUCED	
TOTAL VOLUMES PRODUCED	

NOTES:

PHYSICOCHEMICAL PARAMETERS

DATE	TIME (24 hour)	VOLUME WATER ( )	VOLUME PURGED	WATER LEVEL (FT BTOC)	TEMP ( )	pH	TDS ( )	CONDUCTIVITY ( )	DISSOLVED OXYGEN (PPM)	PID (PPM)	TURBIDITY (NTU)	WATER CLARITY	OBSERVATIONS

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PROJ\FORMS\LOTUS\WELLFRM1.WK1/MML (11-29-95/BJR)

WELL DEVELOPMENT AND/OR GROUNDWATER SAMPLING DATA

PROJECT INFORMATION				
PROJECT NAME	PROJECT NO.	WELL ID	GEOLOGIST/ENGINEER	
DEVELOPMENT/PURGING-SAMPLING	EVENT	START DATE		END DATE

PHYSICOCHEMICAL PARAMETERS

DATE	TIME (24 hour)	VOLUME WATER ( )	VOLUME PURGED	WATER LEVEL (FT BTOC)	TEMP ( )	pH	TDS ( )	CONDUCTIVITY ( )	DISSOLVED OXYGEN (PPM)	PID (PPM)	TURBIDITY (NTU)	WATER CLARITY	OBSERVATIONS

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APPENDIX L-7

LOW STRESS (LOW FLOW) SAMPLING PROCEDURES

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS – FOR METALS ANALYSES

Clayton Environmental Consultants-Chicago Office-Standard Operating Procedure 07
August 6, 1998

Taken from U.S. Environmental Protection Agency - Region I, July 30, 1996, Revision 2.

Equipment:
adjustable rate peristaltic pump;
1/4 to 3/8-inch PVC, polyethylene, or polypropylene tubing;
water level measuring device;
flow measurement supplies (e.g., graduated cylinder and stop watch);
power source;
indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. If possible use a flow-through-cell to measure all listed parameters, except turbidity;
standards to perform field calibration of instruments;
decontamination supplies;
logbook;
sample bottles;
sample labels and chain-of-custody forms.

Note that use of a peristaltic pump limits the groundwater sampling depth to less than about 20 feet below ground surface.

1. Lower tubing into the well to the midpoint of the saturated screen length. If possible keep the tubing at least two feet above the bottom of the well. Ideally this should be done the day before.

2. Before starting pump, measure water level to nearest 0.01 foot.

3. Purge Well

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every 3 to 5 minutes during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 L/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first 15 minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then recover as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

If the recharge rate of the well is lower than extraction rate capabilities of the pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). samples may then be collected even though the indicator field parameters have not stabilized.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (ideally; turbidity, temperature, specific conductance, pH, Eh, DO; at a minimum pH, specific conductance, turbidity or DO) every 3 to 5 minutes. Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at 3 to 5 minute intervals, are within the following limits:

turbidity (10%),
DO (10%),
specific conductance (3%),
temperature (3%),
pH (+ or - 0.1 unit),
ORP/Eh (+ or - 10 millivolts).

All measurements, except turbidity, ideally should be obtained using a flow-through-cell. Use the attached form for recording field measurements. Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

GROUNDWATER DATA FORM

PROJECT INFORMATION

EVENT		Well Development		Groundwater Sampling		Low-Flow Groundwater Sampling

Project Name	Well ID
Project No.	Start Date
Field Personnel	End Date

WELL AND DEVELOPMENT / PURGE INFORMATION

Casing ID	Purging Method	Tube/Pump Intake Depth
Screened Interval	Pump Make, Size, or Type	Pump Rate

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth	Time	Depth	Time
Product				
Groundwater				
Casing Base				

VOLUME PRODUCTION INFORMATION

Volume Type:		Borehole		Well Casing
Linear Feet of Water in Well				
Amount Equal to One Volume				
Total Volumes Produced				

NOTES:

PHYSICOCHEMICAL PARAMETERS

Date	Time (24 hour)	Flow Rate (____)	No. of Vol Removed (#)	Volume Purged (gal)	Depth to Water (ft BTOC)	Drawdown (ft)	Temp (° C)	pH	Conduct. (mS/cm)	TDS (ppm)	Dissolv. Oxygen (ppm)	Eh (mV)	PID (ppm)	Turbid. (ntu)	Visual Clarity

APPENDIX L-8

GROUNDWATER LEVEL MEASUREMENT

Standard Operating Procedure No. 220

GROUNDWATER AND LNAPL LEVEL MEASUREMENTS

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 220 describes the guidelines for determining groundwater and LNAPL levels in monitoring wells, observation wells, and recovery wells as required in the Pre-RA Activities Work Plans or as otherwise specified. The purpose of measuring groundwater and LNAPL levels will be to determine the depth of groundwater and/or LNAPL, hydraulic gradients, LNAPL thickness, and standing water volume in wells.

2.0 EXECUTION

2.1 GENERAL REQUIREMENTS

A. Water level and LNAPL (if present) measurements should be obtained at wells designated in the Pre-RA Activities Work Plan. Water and LNAPL levels should be measured in referenced to a common elevation or datum, preferably to a USGS benchmark located at the site. Water and LNAPL depths should be measured from a reference point marked on the top of the casing which is, in turn, referenced to a permanent benchmark.

B. Water and product level measurement devices shall be decontaminated as per SOP No. 500 or as specified in the Work Plan and FOP before and after measuring at each location.

C. Personnel obtaining water and product level measurements could be subject to exposure from contamination and should follow the Site Health and Safety Plan (SHSP) regarding this activity. Care shall be exercised to avoid direct skin contact while measuring water level and product depth. All equipment should be decontaminated before and after each measurement.

D. Water and product level measurements should be recorded in the field logbook and/or the field activity form. The water/product level measurements form is provided in Attachment 1.

3.0 DISCRETE WATER LEVEL MEASUREMENT METHODS AND PROCEDURES

3.1 METHODS

A. Discrete water level measurements should be made by determining the depth to the water surface from the top of the well casing at the fixed reference point. The fixed reference point is established by permanently marking a point on the northern, outer edge (lip) of the well casing. Caution should be exercised so that filings do not fall into the well.

B. The depth to water can be determined using a steel, add-on tape or electronic water level indicator. The steel add-on tape consists of a measuring tape that has 1-foot increments and a 1-foot section at the end of the tape with 0.01 foot increments. The end of the tape is coated with chalk and lowered into the well. The water depth is read from the saturated mark on the chalked tape and added to the depth interval measured at the top of the well casing.

Electronic water level indicators are conducting probes which activate an alarm and a light when they intersect the water. The sounder wire is marked in 0.01-foot intervals to indicate depth. All sounders are equipped with weights to maintain line tension for accurate readings.

C. Discrete water levels are typically required from a series of wells when data for preparing groundwater contour maps is needed. However, discrete water levels may also be required when monitoring the changes in water level during aquifer testing if aquifer response is sufficiently slow. Continuous water level measurements are discussed in Section 5.0.

3.2 PROCEDURES

3.2.1 **Electronic Water Level Indicator**

A. Lower the sounder wire until it just makes contact with the water in the well and the indicator light goes on or the alarm is sounded. Record the position of the wire relative to the reference point at the top of the well casing. Record the actual water level reading to the nearest 0.01 foot. Repeat to confirm depth.

B. Withdraw the sounder from the well.

C. Record the water depth in the field logbook and/or the field activity form.

D. Decontaminate the sounder wire and electrode in accordance with SOP No. 500.

4.0 DISCRETE LNAPL LEVEL MEASUREMENT METHODS AND PROCEDURES

4.1 METHODS

A. Discrete LNAPL or product level measurements should be made by determining the depth to the product and water surface from the top of the well casing at the fixed reference point. The fixed reference point is established by permanently marking a point on the northern, outer edge (lip) of the well casing. Caution should be exercised so that filings do not fall into the well.

B. The depth of the product and water level should be obtained using an electronic oil/water interface probe. An oil/water interface probe has a multi-conducting probe which activate different signals, typically pulsating beeps and continuous alarms, when they intersect the product and water, respectively. The sounder wire is marked in 0.01-foot increments to indicate depth. The interface probe is equipped with a weight to maintain line tension and obtain accurate readings.

4.2 PROCEDURES

A. Check the interface probe battery by pressing the test button to ensure the device is operating properly prior to and after taking the level measurement. Daily battery checks should also be made and documented in the logbook.

B. Lower the interface probe until it makes contact with the product in the well and the product indicator light goes on or the pulsating alarm is sounded. Record the position of the wire relative to the reference point to the nearest 0.01 foot. Repeat to confirm the depth of the product.

C. Continue to lower the interface probe, through the product layer, until it makes contact with the water level in the well and the water indicator light goes on or the continuous alarm is sounded. Record the position of the wire to the reference point to the nearest 0.01 foot. Repeat to confirm the depth of the water.

D. Withdraw the probe from the well.

E. Record the product and water depth in the field logbook and/or the field activity form.

F. Decontaminate the sounder wire and probe in accordance with the guidelines in SOP No. 500.

5.0 CONTINUOUS WATER LEVEL MEASUREMENT METHODS AND PROCEDURES

5.1 PRESSURE TRANSDUCER METHOD

A. Continuous water level measurements are made by determining the height of the water column above a pressure transducer and electronically recording fluctuations in this height with a data logger. The continuous recording of height of water above the transducer is used for aquifer testing where rapid changes in water level are anticipated.

5.2 PROCEDURES

A. Enter the program into a data logger which has fully-charged batteries. Alkaline batteries are preferred. During use, the battery voltage should not drop below the minimum voltage specified by the manufacturer; damage to the data logger and loss of recorded data could result.

B. Select a pressure transducer for use in a given well that is compatible with both water quality and anticipated pressure sensitivity range (i.e., 5 psi, 30 psi, etc.). The pressure range selected is dictated by the anticipated range in the water column above the transducer and by the desired precision in measurement.

C. Hook up the transducers to the data logger in the field following manufacturer's instructions. Typically, four to eight input channels are available on the system. Other factors affecting the sampling configuration include cable length; distance between monitored wells; terrain; local human activities (traffic, plant operations); and the ability to secure the system from weather and vandals.

D. Attach the transducer cable to the data logger and calibrate in air according to manufacturer's instructions. If multiple data loggers are used, internal clock synchronization should also be performed.

E. Measure water level and depth to the bottom of the well prior to lowering the transducer into the well. Water levels are measured with an electrical water level indicator; total depth of the well is measured with a device compatible with well depth.

F. Secure a sanitary fitting (commonly a gasket adapted to the cable diameter) at the surface of the well. Lower transducer into the well through the sanitary fitting to a depth between the water level and the bottom of the well. The transducer must be kept submerged during the period of measurement. Take care to keep the piezometric crystal at the tip of the transducer out of any fine sediment that has accumulated in the bottom of the well. On some transducers, the crystal is protected from sediment intrusion. Measure water level again; record the time indicated on the data logger digital display and water level. From these readings (and other periodic manual water level measurements), the water levels can be converted to elevations.

G. Transfer data stored in the data logger periodically to a portable computer. The frequency of data transfer depends on available memory and conditions encountered in the field. Data may be transferred as frequently as daily. If the data logger has a wrap-around memory, the information should be transfer so that records are not recorded over.

Standard Operating Procedure No. 220

ATTACHMENT 1
Water / Product Level Measurements Form

ORC Superfund Site

WATER / PRODUCT LEVEL MEASUREMENTS

Date: / / Measuring Device and Serial No.: Measurements taken by:

MEASURING LOCATION	TOP OF CASING ELEVATION (msl)	CORRECTION TO SURVEY MARK (ft)	MEASURING POINT ELEVATION (msl)	DEPTH TO PRODUCT (ft)	DEPTH TO WATER (ft)	PRODUCT LEVEL ELEVATION (msl)	WATER LEVEL ELEVATION (msl)	PRODUCT THICKNESS (ft)	COMMENTS

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APPENDIX L-9

AQUIFER FIELD PERMEABILITY TEST

INSTANTANEOUS HEAD AQUIFER TESTS – "SLUG TESTS"

1.0 PURPOSE OF PROCEDURE

Standard Operating Procedure (SOP) No. 230 describes the guidelines for performing instantaneous head aquifer tests ("slug tests") as specified in the Work Plan, Field Operations Plan (FOP), or as otherwise specified. Instantaneous head aquifer tests are conducted to determine the hydraulic conductivity of formations materials in the vicinity of a well.

2.0 EXECUTION

2.1 GENERAL

A. Instantaneous head tests can also be described as falling head and rising head tests. These tests are utilized in situations where non-equilibrium methods and analyses are appropriate.

B. The application of a slug test involves inducing a sudden change in head (rising or falling) and measuring the response of the water level in the well.

C. Slug tests offer a quick and inexpensive method of obtaining hydraulic conductivity in the field. This method provides a good approximation of bulk horizontal permeability values for the localized zone surrounding a well with hydraulic conductivities less than or equal to 10^{-2} cm/sec.

D. The time required for a slug test to provide sufficient data is related to the volume of the slug, the hydraulic conductivity of the subsurface strata being tested, and the construction of the well. These factors must be such that several incremental changes in groundwater level can be practically measured during the test interval. Slug tests are performed for a minimum of 30 minutes.

E. If the top of the well screen extends above the water table, only a rising head slug test is performed.

F. If the permeability of the soil is such that the water level does not recover to at least 90 percent of the static head during a falling head slug test, a rising head test will not be performed due to dis-equilibrium effects.

2.2 METHODOLOGY

2.2.1 Well Evaluation

A. Select a well, based on well diameter and height of water column in the well, where an instantaneous head test can be performed in a reasonable length of time. It is desirable to run the test to 90 percent recovery (i.e., until 90 percent of the differential head created by insertion or removal of a mechanical slug is dissipated) (Hvorslev, 1951).

B. If the test is run in a piezometer, the filter length of the piezometer should be sufficiently long to provide a representative value of permeability within a 24-hour test period or longer.

2.2.2 Test Procedure

A. Falling Head Test

1. Measure the depth to the static water level in the well.

2. Insert a pressure transducer (5 or 10 psi) in the well at the proper depth interval specified by the manufacturer. Typically the transducer is placed at a depth of 10 to 20 feet below the water level depending on the transducer pressure rating (2.3 feet per psi).

3. Connect the pressure transducer cable to the data logger and anchor it to a stationary object to prevent movement during the test. Use the following recording frequencies to set the data logger:

- 0.2-second intervals from 0 to 2 seconds;
- 1-second intervals from 2 to 20 seconds;
- 5-second intervals from 20 to 120 seconds;
- 0.5-minute intervals from 2 to 10 minutes;
- 2-minute intervals from 10 to 100 minutes;
- 10-minute intervals from 100 to 1,000 minutes; and
- 100-minute intervals from 1,000 minutes to 1 week, if necessary.
- Then at 1-minute intervals for 10 minutes.

4. Quickly insert (DO NOT DROP) a mechanical slug into the well to displace the water level while simultaneously starting the data logger. The mechanical slug should consist of a 5-foot section of 1¼-inch diameter PVC pipe that is filled with clean sand and capped at both ends.

5. Anchor the slug cable or rope to a stationary object (e.g., bumper post) to prevent movement.

6. Record data until 90 percent of the displaced head has recovered. The time required for 90 percent recovery is a function of soil/rock permeability and borehole geometry and may vary from a few minutes to several days. Generally, a minimum of 30 minutes should be allowed for each test.

7. Stop the data logger, download data, and record data on the field activity sheet (see Attachment 1) and/or field logbook.

B. Rising Head Test

1. Measure the depth to the water level (the depth at approximately 90 percent recovery to static water level).

2. Reset data logger to record new data set.

3. Quickly pull the mechanical slug out of the well while simultaneously starting the data logger.

4. Using the same monitoring frequency listed above, record the data until 90 percent of the displaced head has recovered. Generally, a minimum of 30 minutes should be allowed for each test.

5. Stop the data logger, download the data, and record the data on the field activity sheet and/or field logbook.

2.3 SELECTED ANALYTICAL PROCEDURES FOR DATA REDUCTION

Numerous authors have developed methods for analyzing data from instantaneous head tests. The slug test data will be analyzed and the hydraulic conductivity will be calculated using a computer software package called AQTESOLV. AQTESOLV is an interactive program that utilizes statistical parameter estimation methods and graphical curve-matching techniques to analyze aquifer test data. The methods of Bouwer and Rice (1976) and Cooper et.al. (1967) will be used to determine hydraulic conductivity from slug test data obtained from unconfined and confined aquifers, respectively. These methods are discussed below.

2.3.1 Unconfined Aquifer

A. Bouwer and Rice (1976) have developed a procedure that considers the effects from fully or partially penetrating wells, the radius of the gravel pack, and the effective radius of influence of the test in unconfined aquifers. The procedures for this method is provided in the reference document. This method is summarized in Attachment 2.

2.3.2 Confined Aquifer

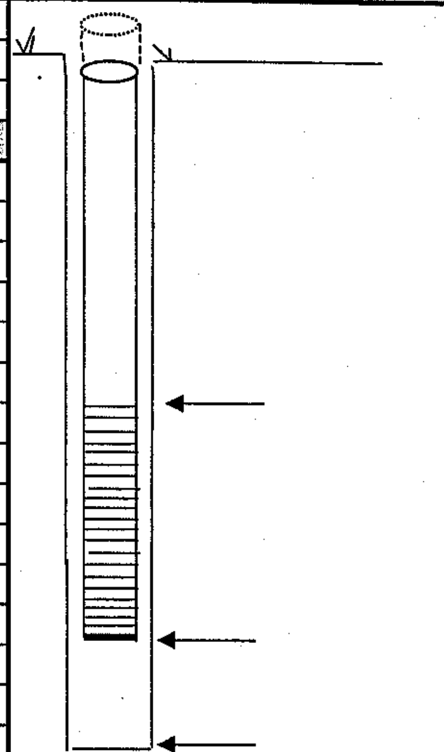
A. Cooper, Bredehoeft, and Papadopulos (1967) developed a set of type curves for estimation of the transmissivity (T) of a confined aquifer after injection or withdrawal of a known volume of water or mechanical slug. The hydraulic conductivity is calculated by the relation $K = T/b$ where b is the thickness of the confined aquifer and K is the hydraulic conductivity of the formation materials. The procedures for this method is provided in the reference document. This method is summarized in Attachment 3.

SLUG TEST DATA FORM

PROJECT INFORMATION		
Project Name	Well ID	
Project No.	Test Date	
Field Personnel	Confined	Unconfined

EQUIPMENT INFORMATION
Data Logger Type / Model No.
Transducer Type / Model No.
Slug Length / Volume

ILLUSTRATION OF INFORMATION



GENERAL INFORMATION				
Static Groundwater Elevation		ft MSL		
Ground Surface Elevation		ft MSL		
Top of Casing Elevation		ft MSL		
Well Stick-up		ft	0.0	cm
Depth to Water Below Grade		ft	0.0	cm
Diameter of Well Casing		in	0.0	cm
Diameter of Borehole at Screen		in	0.0	cm
Screen Interval	-	ft BG	0 - 0	cm BG
Screen Length		ft	0.0	cm
Base of Boring		ft BG	0.0	cm BG
Base of Upper Confining Unit		ft BG	0.0	cm BG
Top of Lower Confining Unit		ft BG	0.0	cm BG
Saturated Thickness (b)		ft	0.0	cm
Static Height of Water in Well		ft	0.0	cm
Geology of Aquifer				

SLUG TEST MEASUREMENT INFORMATION

Parameter	Falling Head				Rising Head			
Initial Water Level Above Transducer		ft	0	cm		ft	0	cm
Initial Drawdown/Recovery		ft	0	cm		ft	0	cm

SLUG TEST RESULTS

Falling H	Rising H	Analysis Method	Parameter	Calculated Value and Units

Notes:

Standard Operating Procedure No. 230

ATTACHMENT 2
Slug Test Method for Unconfined Aquifers

REFERENCE: H. Bouwer and R. C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, Vol. 12, No. 3, pp. 423-428.

SOLUTION:

$$\ln s_o - \ln s_t = \frac{2 K L t}{r_c^2 \ln(r_e/r_w)}$$

where:

s_o = initial drawdown in well due to instantaneous removal of water from well [L]

s_t = drawdown in well at time t [L]

L = length of well screen [L]

r_c = radius of well casing [L]

$\ln(r_e/r_w)$ = empirical "shape factor" determined from tables provided in Bouwer and Rice (19760

r_e = equivalent radius over which head loss occurs [L]

r_w = radius of well (including gravel pack) [L]

H = static height of water in well [L]

b = saturated thickness of aquifer

ATTACHMENT 2
Slug Test Method for Unconfined Aquifers

DEFINITION OF TERMS:

SOURCE: Geraghty & Miller's AQTESOLV™; Version 1.00 Documentation; October 17, 1989; Geraghty and Miller, Inc.; Reston, Virginia.

Standard Operating Procedure No. 230

ATTACHMENT 3
Slug Test Method for Confined Aquifers

REFERENCE: H. H. Cooper, J. D. Bredehoeft, and S. S. Papadopulos. Response of a finite-diameter well to an instantaneous charge of water, Water Resource Research, Vol. 3, No. 1, pp. 263-269.

ASSUMPTIONS:
aquifer has infinite areal extent
aquifer is homogeneous, isotropic, and of uniform thickness
Aquifer potentiometric surface is initially horizontal
a volume of water, V, is injected into or discharged from the well instantaneously
pumping well is fully penetrating
flow to pumping well is horizontal
aquifer is confined
flow is unsteady
water is released instantaneously from storage with decline of hydraulic head
diameter of pumping well is very small so that storage in the well can be neglected

SOLUTION:

Integral solution for dimensionless drawdown in well:

Laplace solution for response in well:

ATTACHMENT 3
Slug Test Method for Confined Aquifers

SOLUTION (Continued):

where:

H = head in well at time t [L]

H_0 = initial head in well due to slug injection or extraction [L]

α = $r_w^2 S / r_c^2$ [dimensionless]

r_w = effective radius of well [L]

r_c = internal radius of well [L]

β = Tt/r_c^2

J_0 = Bessel function of first kind, zero order

J_1 = Bessel function of first kind, first order

Y_0 = Bessel function of second kind, zero order

Y_1 = Bessel function of second kind, first order

K_0 = modified Bessel function of second kind, zero order

K_1 = modified Bessel function of second kind, first order

SOURCE: Geraghty & Miller's AQTESOLV™; Version 1.00 Documentation; October 17, 1989; Geraghty and Miller, Inc.; Reston, Virginia.

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APPENDIX L-10

POTABLE WATER WELL SAMPLING PROCEDURES

C. PROCEDURES

Even though the same care and techniques used in other media sampling (i.e., ensuring that all field equipment is available and in good working order, confirming that sample coolers contain sufficient ice or cool packs to chill all anticipated samples to less than four (4) degrees Centigrade for at least twelve hours, completing chain-of-custody forms, etc.) are used when sampling private water wells, there are certain additional special procedures which shall be used.

1. Primary groundwater parameters for drinking water samples measured in the field, in addition to the specific parameters ordered for laboratory analysis, include pH, specific conductance, and water temperature.

    a. Begin with a clean, well-functioning instrument, and calibrate each day for accuracy by measuring known standards. Follow the instructions provided with the equipment to ensure proper calibration.

    b. Avoid dehydration of sensors, extreme temperatures, and excessive vibration when transporting the instrument to the field. All of these factors can affect the sensitivity of the equipment and damage various parts of the system.

2. To ensure that the water sample is representative of the groundwater, you must avoid altering the sample with outside sources of contamination.

    a. Ask if the owner obtains water from any other sources, i.e. whether water is hauled in.

    b. Wear latex gloves without talc. Latex gloves are also worn to avoid burning your hands with the HCL preservative contained in the vial when filling VOC bottles.

Note: Oftentimes the homeowner will wonder if his/her drinking water is so badly contaminated that we must protect our hands while collecting the sample. Reassure the person that the gloves are used to ensure that the sample collected is not being contaminated by us or to avoid acid burns from the preservatives.

    c. Collect the sample at a point prior to introduction into a water heater, holding tank, cistern, water softener/conditioner, or home filtering system.

    d. Protect the sampling tap from exterior contamination associated with being too close to the sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collecting procedure since it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface.

e. Avoid leaking taps that allow water to flow out from around the stem of the valve handle and down the outside of the faucet, or taps in which water tends to run up on the outside of the lip.

f. Remove any aerator and/or water hose from the tap prior to sample collecting.

3. To obtain a representative sample from private wells, the wells must be purged before the sample is collected.

a. Open the cold water tap to allow for a smooth flow at a moderate pressure. The rate of flow can be measured easily by placing a one-gallon calibrated bucket under the tap and measuring the time required to fill the bucket. The tap must be allowed to run until the temperature, pH, and specific conductivity readings become stabilized to ensure water standing in the well or holding tank is removed.

Often the homeowner will request that you not waste his/her water while purging the well. Therefore, you may want to use this running water on a garden or flower bed. However, the those must be removed prior to collecting the sample.

b. Measure the temperature, pH, and specific conductivity at the initial purging, after ten minutes of purging, and again immediately prior to the sample collection.

c. Record unusual physical characteristics, color, odor or turbidity in the groundwater in the field notes.

d. Do not place the bottle cap on the ground or in a pocket regardless of the type of sample bottle being used.

e. Hold the bottle in one hand and the cap in the other, using care not to touch the inside of the cap.

f. Avoid contaminating the sample bottle with fingers or permitting the faucet to touch the inside of the bottle.

g. Take care when filling any container so splashing drops of water from the ground or sink do not enter into either the bottle or cap.

h. Do not adjust the stream flow while sampling to avoid dislodging particles in the pipe or valve.

4. When collecting drinking water samples for volatile organic chemicals, contract laboratories require that the pH of the sample be lowered by the addition of three drops of 1:1 hydrochloric acid (HCL) to each bottle. Vials obtained from the Bottle Distribution Center already contain the prescribed amount of HCL. Take special care when handling the HCL; wear disposable gloves to avoid burning your hands.

   a. Carefully fill the vial to slightly above the rim but not enough to allow the sample to overflow. Overflowing the bottle will result in loss of the preservative.

   b. Exercise care not to lose the Teflon liner.

   c. Do not rinse the vial, nor excessively overfill it. There should be a convex meniscus on the top of the vial.

   d. Check that the cap has not been contaminated.

   e. Place the sample vial on a level surface.

   f. Position the Teflon side of the septum seal directly over top and upon the convex sample meniscus. For the best results, lower the cap on to the sample - do not place it on the sample sideways; placing the cap on sideways will knock off the meniscus and result in air bubbles in the sample.

   g. Screw the cap down firmly - do not over tighten and break the cap.

   h. Invert the vial and tap gently on the palm of your hand. A successful seal is one in which no air bubbles are present in the sample.

(When collecting drinking water samples for volatile organic contaminants, contract laboratories require five 40 ml vials of water sample. Agency laboratory requires two 40 ml vials)

   i. Pre-label sample bottles appropriately. (Avoid opening permanent or magic marker around open sample vial.)

   j. Wipe off the sample container with paper towel.

   k. Wrap each vial with plastic bubble wrap.

l. Place each set of five into plastic Zip-loc bags and seal baggie with evidence tape.

m. Place into coolers, ensuring four (4) degrees centigrade is maintained surrounding the samples. Do not place vials directly on ice to avoid breaking of bottles.

If air is trapped in the bottle:

- Open the vial and add a few additional drops of water and reseal the bottle as indicted above. If bubbles persist, pour out, obtain a new sample bottle, and repeat entire process.

D. REFERENCES

American Petroleum Institute: Manual of Sampling Analytical Methods for Petroleum Hydrocarbons in Groundwater and Soil., 1990.

Garrett, Peter. How to Sample Groundwater and Soils. 1988.

Hanson, David. "Drinking Water Limits Set for 23 More Compounds." Chemical and Engineering News. June 1, 1992; p 23.

IEPA. A Field Guide for Environmental Sampling. Division of Laboratories.. December 1991.

IEPA. Quality Assurance/Quality Control Procedures fro Groundwater Sampling. Division of Public Water Supply. October 1991.

IEPA. Users Manual for the IEPA Contract Lab Program. Bureau of Land Pollution Control. May 1989.

U.S. EPA. Existing and Proposed U.S. EPA MCLs in Drinking Water. May 1989.

U.S. EPA. Groundwater, Volume II: Methodology. EPA/625/6-90-016b. July 1991: pp 45-63.

U.S. EPA. Handbook for Sampling and Sample Preservation of Water and Wastewater. EPA-600/4-82-029 September 1982: pp 262-265, 370-377.

U.S. EPA. Samplers guide to the Contract Laboratory Program. EPA/540/P-90-006. December 1990: pp 10-14.

APPENDIX M

LANDFILL GROUNDWATER MONITORING SUMMARY TABLES

M-1 Compliance Monitoring Wells – VOC Data
M-2 Compliance Monitoring Wells – Inorganic Data
M-3 Assessment Monitoring Wells – VOC Data
M-4 Assessment Monitoring Wells – Inorganic Data

APPENDIX M-1

COMPLIANCE MONITORING WELLS – VOC DATA

Table 4. Volatile Organic Compounds - Quarter 3, 1999

1999 Annual Groundwater Report
Equistar Chemicals, LP; Tuscola, Illinois

PARAMETER	STORET CODE	MONITORING WELL NUMBER G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112	R113	G114	G115	G116	G117
1,1,1-Trichloroethane, total	34506	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane, total	34516	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane, total	34511	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane, total	34496	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	34501	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichloropropane, total	77443	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane, total	34531	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
2-Butanone (Methyl Ethyl Ketone)	81595	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Chloroethyl vinyl ether, total	34576	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Hexanone	77103	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-Methyl-2-Pentanone	78133	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Acetone	81552	<20	110	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Acrolein	34210	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Acrylonitrile	34215	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70
Benzene	34030	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromodichloromethane, total	32101	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform, total	32104	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon Disulfide	77041	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride, total	32102	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene, total	34301	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorodibromomethane (Dibromochloromethane)	32105	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane, total	34311	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform, total	32106	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	34704	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dichlorodifluoromethane, total	34668	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethyl Methacrylate	73570	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene, total	78113	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Iodomethane	77424	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Bromide (Bromomethane), total	34413	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Chloride (Chloromethane), total	34418	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methylene Bromide (Dibromomethane), total	77596	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylene Chloride (Dichloromethane), total	34423	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene	77128	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethene, total	34475	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene, total	34010	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans 1,2-Dichloroethene, total	34546	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,3-Dichloropropylene, total	34699	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene, total	39180	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichlorofluoromethane, total	34488	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Acetate	77057	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Vinyl Chloride, total	39175	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Xylene, total	81551	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Notes:
< Below method detection limit.
All concentrations are shown in micrograms per Liter.

h:/equistar/iepa/1999/annual/1999rawdata.xls

Table 5. Volatile Organic Compounds - Quarter 2, 2000

2000 Annual Groundwater Report
Equistar Chemicals, LP; Tuscola, Illinois

PARAMETER	STORET CODE	MONITORING WELL NUMBER																
		G101	G102	G103	G105	G106	G107	G108	G109	G110	G111	G112	R113	G114	G115	G116	G117	G118
Toluene, total	34010	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Benzene	34030	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene, total	34301	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane, total	34311	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethene, total	34475	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	34501	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,1-Trichloroethane, total	34506	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane, total	34511	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane, total	34531	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans 1,2-Dichloroethene, total	34546	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trichlorobenzene	34551	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,4-Dichlorobenzene	34571	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Naphthalene	34696	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Chloride, total	39175	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis 1,2-Dichloroethene	77093	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trimethylbenzene	77222	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3,5-Trimethylbenzene	77226	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4-Isopropyltoluene	77356	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene, total	39180	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene, total	78113	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Xylene, total	81551	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Notes:
< Below method detection limit.
All concentrations are shown in micrograms per Liter.
Samples collected on April 4, 2000.

TABLE 2

Annual Organic Parameter Data for Landfill Compliance Monitoring Wells G101 to G118 Compared to Class II Groundwater Standards

Quarter 2, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Storet Code	Compounds	Unit	Downgradient Monitoring Wells															Background Wells		PQL	Class II Groundwater Standards
			G101 4/26/2001	G102 4/26/2001	G103 4/26/2001	G105 4/26/2001	G106 4/25/2001	G107 4/25/2001	G108 4/25/2001	G109 4/26/2001	G110 4/25/2001	G111 4/25/2001	G112 4/25/2001	R113 4/25/2001	G114 4/25/2001	G115 4/25/2001	G118 4/26/2001	G116 4/24/2001	G117 4/25/2001		
Volatile Organic Compounds																					
34506	1,1,1-Trichloroethane, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	1000
34511	1,1,2-Trichloroethane, total	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5 ug/L	50
34501	1,1-Dichloroethene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	35
34551	1,2,4-Trichlorobenzene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10.0 ug/L	700
77222	1,2,4-Trimethylbenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	NS
34531	1,2-Dichloroethane, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	25
77226	1,3,5-Trimethylbenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	NS
34571	1,4-Dichlorobenzene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	NS
77356	4-Isopropyltoluene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0 ug/L	NS
34030	Benzene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.6 ug/L	25
34301	Chlorobenzene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	500
34311	Chloroethane, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	500
77093	cis 1,2-Dichloroethene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10.0 ug/L	NS
78113	Ethylbenzene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	200
34475	Tetrachloroethene, total	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	0.7 ug/L	25
34010	Toluene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	1000
34546	trans 1,2-Dichloroethene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	2500
39180	Trichloroethene, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0 ug/L	500
39175	Vinyl Chloride, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 ug/L	25
81551	Xylenes, total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 ug/L	10
		ug/L	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	5.0 ug/L	10000
Total Organic Halogens (TOX)																					
78115	Halogen, Total Organic	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-- ug/L	NS
Semi Volatile Organic Compounds																					
39100	Bis (2-ethylhexyl) phthalate	ug/L	<5.0	<5.0	3 J	<5.0	<5.0	1 J	5.4	<5.0	<5.0	***33***	<5.0	3 J	1 J	<5.0	<5.0	<5.0	<5.0	6.0 ug/L	60
34696	Naphthalene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10.0 ug/L	NS

NOTES: ug/L = micrograms per liter.
< = Below the method detection limit.
NS = No Standard.
PQL = Practical Quantitation Limit required by Supplemental Permit 2000-032-SP.
Bis (2-ethylhexyl) phthalate is a synonym for Di (2-ethyl hexyl) phthalate.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
Bold-face and italicized value in a box indicates that the concentration represents an organic parameter exceedance in accordance with Supplemental Permit 2000-032-SP.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
G104 deleted from the monitoring program.

APPENDIX M-2

COMPLIANCE MONITORING WELLS – INORGANIC DATA

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G101 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	11/10/94	20 <	88	740	10 <	10 <	50 <	50 <	- -	20 <	7.39	13.7	37	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	82 <	760	10 <	10 <	50 <	50 <	- -	10 <	7.10	117	22	- -	- -	- -	- -	- -	- -
	06/06/95	10 <	88	670	10 <	10 <	59	50 <	- -	12	7.20	217	40	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	99	670	17	10 <	50 <	50 <	- -	20 <	7.20	59.3	33	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	85	630	10 <	10 <	63	50 <	- -	20 <	7.70	26.1	20	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	76	620	10 <	10 <	50 <	50 <	- -	20 <	7.20	48.4	22	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	92	590	10 <	11	50 <	50 <	- -	23	7.36	44.1	660	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	93	630	10 <	10 <	50 <	50 <	- -	10 <	7.40	30.9	35	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	84	650	50 <	50 <	250 <	250 <	- -	50 <	7.70	33.7	50	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	130	800	14	10 <	3,500	50 <	- -	12	7.34	93.9	90	- -	- -	- -	- -	- -	- -
	05/22/97	20 <	67	600	10 <	10 <	50 <	50 <	- -	20 <	7.45	30.0	15	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	74	610	10 <	10 <	50 <	50 <	- -	20 <	- -	25.4	62	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	71	600	11	10 <	50 <	50 <	- -	20 <	7.35	24.6	30	- -	- -	- -	- -	- -	- -
	09/24/98	50 <	78	590	3 <	2.5 <	3	10 <	270	5.1	**6.06**	25	32	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	79	600	5 <	2.5 <	10 <	5.0 <	280	5.8	6.50	21	5	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	76	630	10	2.5 <	10 <	5.0 <	16	5 <	**5.30**	22	5	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	83	560	5 <	6.4	10 <	5.0 <	67	5 <	7.10	20	5	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	81	620	5 <	2.6	10 <	5.0 <	260	5 <	6.70	19	8.6	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	83	620	5 <	2.5	10 <	5.0 <	260	5 <	7.32	18	5.8	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	82	650	5 <	3.2	10 <	7.5 <	25	5 <	7.13	20	NA	0.29	0.0020 <	5.0 <	0.0002 <	360	0.02
	04/04/00	5 <	78	570	5 <	2.5 <	10 <	5.0 <	170	5 <	7.40	16	NA	0.31	0.0020 <	5.0 <	0.0002 <	360	0.01 <
	08/02/00	5 <	87	560	5 <	2.5 <	48	5.0 <	350	10 <	7.43	22	NA	0.24	0.0020 <	5.0 <	0.0002 <	420	0.01 <
	10/17/00	5 <	85	620	5 <	20 <	54	5.0 <	380	11	7.05	21	NA	0.34	0.0020 <	5.0 <	0.0002 <	380	0.022
	02/13/01	5 <	79	670	6.1	8.1	100 <	3.0 <	50 <	7.7	7.08	19	NA	1.0 <	0.00098	1.2	0.0002 <	360	0.10 <
	04/26/01	6.5	84	620	5.6	6.0	100 <	19	240	8.0	**9.14**	18	NA	1.0 <	0.0005 <	1.0 <	0.0002 <	320	0.10 <
	08/08/01	5 <	83	610	2 J	3 J	100 <	3 <	390	5.4	7.40	21	NA	1.0 <	0.0005 <	1.0 <	0.0002 <	350	0.018
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	**Yes**	No	No	No	No	**Yes**	No	No	No	NA	No*	No	No	No	No	No
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	**Yes**	No	No	No	**Yes**	**Yes**	No	**Yes**	No	NA	No*	No	No	No	No	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
Parameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit No. 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G102 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/07/94	20 <	200 <	940	10 <	10 <	50 <	50 <	- -	20 <	7.72	47.50	20 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	80	880	10 <	10 <	50 <	50 <	- -	10 <	7.57	35.10	85	- -	- -	- -	- -	- -	- -
	02/27/95	10 <	92	800	10 <	10 <	50 <	50 <	- -	10 <	6.80	46.20	20 <	- -	- -	- -	- -	- -	- -
	06/06/95	10 <	88	730	10 <	10 <	50 <	50 <	- -	19	7.70	64.70	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	94	730	160	10 <	50 <	50 <	- -	20 <	7.50	80.10	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	86	760	10 <	10 <	150	50 <	- -	20 <	7.60	82.40	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	79	840	10 <	10 <	50 <	50 <	- -	20 <	7.10	89.60	22	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	100	740	10 <	10 <	120	50 <	- -	10 <	7.23	91.80	650	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	100	740	10 <	10 <	50 <	50 <	- -	10 <	7.18	85.50	24	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	100	770	50 <	50 <	250 <	250 <	- -	50 <	7.34	78.30	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	720	620	10 <	10 <	50 <	50 <	- -	10 <	7.75	29.60	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	95	790	10 <	10 <	12	50 <	- -	20 <	7.33	81.00	40	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	99	720	10 <	10 <	290	50 <	- -	20 <	- -	91.20	72	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	92	750	12	10 <	50 <	56	- -	20 <	7.10	79.80	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	50 <	90	710	3 <	2.8	7	10 <	9.6	4.6	**6.44**	91	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	99	740	5 <	2.5 <	150	5 <	53.0	8.4	**6.10**	87	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	92	810	27	3.7	10 <	5 <	5.0 <	13.0	7.09	89	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	95	710	13	7.0	10 <	5 <	16.0	5.3	7.29	93	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	87	740	5 <	2.5 <	20	5 <	110.0	5.1	7.14	88	5 <	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	91	730	5 <	2.5 <	69	5 <	65.0	5 <	7.18	85	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	91	760	5 <	2.5 <	10 <	7.5 <	18.0	5 <	7.62	82	NA	0.20	0.0020 <	5.0 <	0.0002 <	480	0.01 <
	04/04/00	5 <	86	770	5 <	2.5 <	10 <	5 <	150.0	5 <	7.31	140	NA	0.23	0.0020 <	6.7	0.0002 <	550	0.01 <
	08/02/00	5 <	95	650	5 <	2.5 <	100	5 <	140.0	10 <	7.32	96	NA	0.13	0.0020 <	7.4	0.0002 <	530	0.01 <
	10/17/00	5 <	95	700	5 <	20 <	25 <	5 <	72.0	15	7.20	110	NA	0.12 <	0.0020 <	6.8	0.0002 <	480	0.008 <
	02/13/01	5 <	93	760	5 <	9.8	100 <	3 <	76	12	7.09	99	NA	1.0 <	0.0005 <	4.7	0.0002 <	480	0.10 <
	04/26/01	3 J	92	810	4 J	7.2	100 <	3 <	230	16	8.30	110	NA	1.0 <	0.0003 J	4.8	0.0002 <	450	0.10 <
	08/08/01	5 <	88	710	3 J	3 J	100 <	3 <	210	5	7.30	75	NA	1.0 <	0.0005 <	4.3	0.0002 <	490	0.006 J
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	**Yes**	No	No	No	No	**Yes**	No	No	No	NA	No*	No	No	No	No	No
Confidence Limit Exceeded in Q2, 2001		No	No	**Yes**	No	No	No	No	**Yes**	No	**Yes**	No	NA	No*	No	No	No	No	No*

NOTES:

- - = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001
Permit No. 1993-004-DE/OP (Post-Closure)
Supplemental Permit No. 2000-032-SP
ILD 005078126 -- Douglas County -- 0418080002
Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G103 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/07/94	20 <	280	220	10 <	10 <	**29,000**	58	- -	20 <	7.37	10 <	20 <	- -	- -	- -	- -	- -	- -
	11/10/94	20 <	210	230	12	10 <	**5,200**	50 <	- -	10 <	6.66	10	30 <	- -	- -	- -	- -	- -	- -
	03/01/95	10 <	210	200	10 <	10 <	**20,000**	50 <	- -	10 <	6.80	59	20	- -	- -	- -	- -	- -	- -
	06/06/95	10	330	170	10 <	10 <	**34,000**	50 <	- -	10 <	6.90	114	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	290	170	30	10 <	**29,000**	150	- -	20 <	7.10	103	20 <	- -	- -	- -	- -	- -	- -
	12/01/95	11	270	200	10 <	10 <	**31,000**	110	- -	20 <	6.90	67	20 <	- -	- -	- -	- -	- -	- -
	03/13/96	10 <	230	150	10 <	10 <	**19,000**	100	- -	20 <	7.30	134	26	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	240	150	10 <	10 <	**17,000**	93	- -	10 <	6.91	179	18	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	200	150	10 <	10 <	**10,000**	100 <	- -	10 <	6.88	188	21	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	180	500 <	50 <	50 <	**5,900**	250 <	- -	50 <	7.07	172	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	140	150	10 <	10 <	**12,000**	50 <	- -	10 <	7.03	179	20	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	200	150	10 <	4.3	**19,000**	50 <	- -	20 <	6.86	179	19	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	180	150	10 <	10 <	**23,000**	89	- -	20 <	- -	89	44	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	190	150	22	10 <	**12,000**	50 <	- -	20 <	6.82	128	30 <	- -	- -	- -	- -	- -	- -
	09/25/98	47	120	140	2.5 <	2.5 <	**7,800**	17	1,300	6	7.01	150	8.7	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	120	150	5 <	2.5 <	**5,900**	5 <	1,200	5 <	6.00	140	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	130	150	5 <	2.5 <	**7,800**	5 <	1,100	5 <	7.26	170	7.8	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	120	130	5 <	3.6	**6,100**	5 <	1,200	5 <	7.58	190	48	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	110	150	5 <	2.5 <	**13,000**	5 <	1,200	5 <	6.96	200	14	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	140	150	5 <	2.5 <	**15,000**	9.0	1,300	5 <	6.97	140	5.6	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	150	170	5 <	2.5 <	**18,000**	7.5 <	1,300	5 <	7.00	75	NA	22	0.005	15	0.0002 <	860	0.01 <
	04/04/00	5 <	230	190	5 <	2.5 <	**32,000**	5 <	1,500	5 <	**9.44**	15	NA	22	0.0034	9.2	0.0002 <	890	0.01 <
	08/02/00	15	250	210	5 <	2.5 <	**36,000**	5 <	1,400	10 <	7.59	19	NA	17	0.0094	10	0.0002 <	900	0.01 <
	10/17/00	17	250	220	5 <	20 <	**31,000**	5 <	1,300	21	7.25	69	NA	16	0.0025	14	0.0002 <	770	0.019
	02/13/01	6.3	230	210	5 <	5 <	**23,000**	3 <	1,200	10	6.61	56	NA	17	0.0005 <	7.0	0.0002 <	740	0.10 <
	04/26/01	15	200	360	3 J	3 J	**32,000**	3 <	1,300	10	8.22	15	NA	26	0.0005 <	1.0 <	0.0002 <	530	0.10 <
	08/08/01	7.3	150	220	5 <	5 <	**34,000**	3 <	1,200	4 J	6.70	5.6	NA	19	0.0005 <	6.7	0.0002 <	660	0.010 <
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**	No	No	No	NA	**Yes**	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**	No	**Yes**	No	NA	**Yes**	No	No	No	**Yes**	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit . 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G105 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	11/11/94	60	29	940	10 <	10 <	50 <	50 <	- -	64	**6.34**	**3,120**	37	- -	- -	- -	- -	- -	- -
	03/01/95	22	10 <	650	10 <	10 <	74	50 <	- -	67	6.70	**2,670**	55	- -	- -	- -	- -	- -	- -
	06/06/95	32	10 <	770	10 <	10 <	490	50 <	- -	67	6.70	**3,490**	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	33	10 <	1,300	52	10 <	380	50 <	- -	73	6.50	**3,500**	20 <	- -	- -	- -	- -	- -	- -
	12/01/95	28	10 <	1,100	10 <	10 <	740	50 <	- -	42	**6.20**	**3,460**	20 <	- -	- -	- -	- -	- -	- -
	03/13/96	46	20 <	830	20 <	20 <	100 <	100 <	- -	80 <	6.70	**2,900**	40 <	- -	- -	- -	- -	- -	- -
	06/12/96	44	20 <	1,000	20 <	20 <	100 <	10 <	- -	31	6.51	**3,410**	110	- -	- -	- -	- -	- -	- -
	08/29/96	28	10 <	1,100	10 <	10 <	50 <	50 <	- -	53	**6.33**	**3,060**	20 <	- -	- -	- -	- -	- -	- -
	12/10/96	32	50 <	1,200	50 <	50 <	250 <	250 <	- -	120	**6.37**	**3,700**	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	28	10 <	1,100	10 <	10 <	300	50 <	- -	70	**6.34**	**2,960**	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	89	10 <	1,000	10 <	10 <	640	50 <	- -	64	**6.29**	**2,980**	30 <	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	10 <	1,400	10 <	10 <	370	50 <	- -	66	- -	**2,970**	31	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	10 <	1,400	32	10 <	1,300	50 <	- -	76	**6.32**	**2,730**	52	- -	- -	- -	- -	- -	- -
	09/25/98	76	11	1,300	7.8	3.8	680	28	8,400	53	**6.48**	**2,700**	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	13	1,100	5.4	2.5 <	19	11	6,800	37	**6.00**	**2,800**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	60	50 <	1,100	5 <	2.5 <	130	8	9,800	5 <	6.57	**2,100**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50	50 <	1,100	6.2	2.5 <	270	5 <	9,300	49	6.51	**3,000**	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	50 <	1,400	5 <	2.5 <	730	7.7	9,000	42	**6.20**	**3,000**	5.4	- -	- -	- -	- -	- -	- -
	11/15/99	50 <	50 <	1,100	5 <	2.5 <	10 <	11.0	6,800	33	**5.59**	**3,100**	5.4	- -	- -	- -	- -	- -	- -
	01/10/00	66	20 <	980	5 <	5.1	11	7.5 <	6,400	32	6.72	**2,900**	NA	0.13	0.0031	35	0.0002 <	**4,800**	0.02
	04/04/00	120	20 <	1,100	5.8	20	10 <	5 <	7,800	66	6.68	**3,600**	NA	0.12	0.0020 <	40	0.0002 <	**5,600**	0.06
	08/03/00	110	20 <	1,400	5 <	3.4	53	5 <	7,300	77	**6.18**	**3,300**	NA	0.10 <	0.0028	46	0.0002 <	**5,400**	0.05
	10/17/00	100	20 <	1,400	5 <	20 <	25 <	5 <	7,000	130	**6.17**	**3,100**	NA	0.88	0.0020 <	49	0.0002 <	**5,100**	0.046
	02/13/01	81	10	1,400	5 <	7.2	100 <	3 <	6,700	88	**6.12**	**5,400**	NA	1.0 <	0.0011	41	0.0002 <	**4,700**	0.10 <
	04/26/01	75	8.6	1,600	4 J	7.4	210	3 <	6,600	82	7.53	**2,600**	NA	1.0 <	0.0005 <	41	0.0002 <	**3,900**	0.10 <
	08/09/01	63	12	1,600	5 <	4 J	220	3 <	7,300	65	**6.30**	**3,000**	NA	1.0 <	0.0005 <	43	0.0002 <	**5,000**	0.095
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		**Yes**	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	NA	No*	No	**Yes**	No	**Yes**	**Yes**
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	No	No	**Yes**	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
Parameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit \. 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G106 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	11/10/94	20 <	25	230	10 <	21	50 <	50 <	- -	20	6.88	**3,650**	30	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	14	210	10 <	33	50 <	50 <	- -	10 <	6.80	**1,750**	77	- -	- -	- -	- -	- -	- -
	06/06/95	10 <	10 <	190	10 <	10 <	50 <	50 <	- -	20 <	6.90	**1,830**	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	14	220	40 <	10 <	22	50 <	- -	20 <	7.40	**705**	20 <	- -	- -	- -	- -	- -	- -
	12/01/95	10 <	14	200	10 <	10 <	170	50 <	- -	20 <	7.20	**1,260**	20 <	- -	- -	- -	- -	- -	- -
	03/13/96	10 <	19	120	10 <	10 <	50 <	50 <	- -	20 <	7.20	**1,200**	20 <	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	11	160	10 <	17	50 <	50 <	- -	10 <	7.62	**1,320**	91	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	50 <	500 <	50 <	50 <	250 <	250 <	- -	50 <	7.16	**1,390**	50 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	7.7	140	10 <	3.2	50 <	50 <	- -	20 <	7.24	**1,190**	14	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	15	180	10 <	10 <	72	50 <	- -	20 <	- -	**927**	73	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	10 <	130	25	10 <	50 <	50 <	- -	20 <	7.11	**1,730**	30 <	- -	- -	- -	- -	- -	- -
	09/25/98	50 <	19	190	3	3.1	2.3	14	- -	8.5	6.94	**1,600**	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	21	190	5 <	2.5 <	10 <	6.2	- -	6.9	**6.00**	**1,800**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	130	5 <	2.5 <	10 <	5 <	5 <	5 <	7.32	**1,400**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	120	5 <	4.0	10 <	5 <	22	5 <	7.18	**1,500**	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	50 <	180	5 <	2.5 <	10 <	5 <	140	5 <	7.07	**1,100**	5 <	- -	- -	- -	- -	- -	- -
	11/15/99	50 <	50 <	200	5 <	2.5 <	10 <	5.9	110	5 <	**6.38**	**1,500**	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	23	200	5.4	3.5	16	7.5 <	30	5 <	7.15	**1,300**	NA	0.12	0.0020 <	24	0.0002 <	**2,400**	0.01 <
	04/04/00	5 <	21	130	5 <	2.5 <	10 <	5 <	5 <	5 <	7.34	**1,500**	NA	0.10 <	0.0020 <	30	0.0002 <	**2,500**	0.10
	08/03/00	5 <	24	210	5 <	2.5 <	37	5 <	13	10 <	7.04	**1,500**	NA	0.10 <	0.0020 <	23	0.0002 <	**2,500**	0.02
	10/17/00	5 <	20 <	200	5 <	20 <	25 <	5 <	5 <	11	6.97	**1,300**	NA	0.46	0.0020 <	27	0.0002 <	**2,200**	0.016
	02/13/01	5 <	15	310	5 <	5 <	100 <	3 <	50 <	15	7.02	**970**	NA	1.0 <	0.0005 <	17	0.0002 <	**1,900**	0.10 <
	04/25/01	2 J	15	750	4 J	6.2	100 <	3 <	100 <	24	7.94	**1,600**	NA	1.0 <	0.0005 <	20	0.0002 <	**2,400**	0.10 <
	08/09/01	5 <	20	270	3 J	5 J	100 <	3 <	190	14	7.3	**1,700**	NA	1.0 <	0.0005 <	21	0.0002 <	**2,700**	0.029
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	No	No	**Yes**	No	No	**Yes**	NA	No*	No	No	No	**Yes**	**Yes**
Confidence Limit Exceeded in Q2, 2001		No	No	**Yes**	No	No	No	No	No*	**Yes**	No	**Yes**	NA	No*	No	No	No	**Yes**	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
Parameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit No. 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G107 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	11/10/94	20 <	230	320	10 <	10 <	50 <	50 <	- -	20 <	7.54	189	40 <	- -	- -	- -	- -	- -	- -
	02/28/95	20 <	180	180	10 <	14	50 <	50 <	- -	10 <	7.40	150	35	- -	- -	- -	- -	- -	- -
	06/06/95	10 <	150	250	10 <	11	50 <	50 <	- -	10 <	7.00	163	47	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	160	280	10 <	10 <	50 <	50 <	- -	10 <	6.90	162	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	170	350	20	10 <	50 <	50 <	- -	20 <	7.40	176	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	150	370	10 <	10 <	50 <	50 <	- -	20 <	7.40	182	20 <	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	130	280	10 <	10 <	50 <	50 <	- -	20 <	7.40	157	20 <	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	170	300	10 <	11	50 <	50 <	- -	10 <	7.23	173	150	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	150	320	10 <	10 <	50 <	50 <	- -	10 <	7.36	179	23	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	160	500 <	50 <	50 <	250 <	250 <	- -	50 <	7.23	171	50 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	110	270	10 <	10 <	29	50 <	- -	20 <	7.45	166	380	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	130	200	10 <	10 <	50 <	50 <	- -	20 <	- -	171	53	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	110	260	14	10 <	50 <	50 <	- -	20 <	7.18	174	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	50 <	110	170	2.7	2.9	2.5 <	10 <	6.3	2.9	7.57	180	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	120	230	5 <	2.5 <	10 <	5 <	5 <	5	**6.40**	180	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	120	240	5 <	2.6	10 <	5.7	5 <	5 <	7.56	180	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	120	220	5 <	8.0	10 <	5 <	5 <	5 <	7.46	180	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	110	230	5 <	2.5 <	19	5 <	11	5 <	7.30	170	8.8	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	120	240	5 <	2.5 <	10 <	5 <	7	5 <	7.32	160	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	120	250	5 <	2.5 <	10 <	7.5 <	5 <	5 <	7.37	160	NA	0.15	0.0020 <	16	0.0002 <	560	0.01 <
	04/04/00	5 <	110	170	5 <	2.5 <	46	5 <	5 <	5 <	7.55	220	NA	0.10 <	0.0020 <	19	0.0002 <	620	0.01 <
	08/03/00	5 <	120	210	5 <	2.5 <	11	5 <	16	10 <	7.28	210	NA	0.10 <	0.0020 <	21	0.0002 <	670	0.01 <
	10/17/00	5 <	120	230	5 <	20 <	25 <	5 <	7.2	10 <	7.25	230	NA	0.36	0.0020 <	32	0.0002 <	620	- - 2
	02/13/01	5 <	120	290	5 <	5 <	100 <	3 <	50 <	9.1	7.15	310	NA	1.0 <	0.0005 <	18	0.0002 <	630	0.10 <
	04/25/01	3 J	110	140	8.4	7.4	100 <	3 <	100 <	15	8.36	220	NA	1.0 <	0.0005 <	19	0.0002 <	560	0.10 <
	08/09/01	5 <	110	240	5.4	3 J	100 <	3 <	15 <	5.8	7.7	190	NA	1.0 <	0.0005 <	23	0.0002 <	640	0.006 J
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	No	No	No*	No	No	**Yes**	NA	No*	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		No	No	No	**Yes**	No	No	No	No*	No	**Yes**	**Yes**	NA	No*	No	No	No	**Yes**	No*

NOTES:

-- = No data collected.

J = Estimated value. Compound detected below the practical quantitation limit (PQL).

NA = Not applicable.

No* = Detection limit above Upper Confidence Limit.

Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.

1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.

ug/L = Micrograms per liter.

mg/L = Milligrams per liter.

< = Below the method detection limit.

G104 deleted from the monitoring program.

Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.

Parameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G108 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/07/94	20 <	200 <	240	10 <	10 <	280	50 <	- -	30	6.76	**6,920**	40 <	- -	- -	- -	- -	- -	- -
	11/10/94	23	43	180	10 <	10 <	50.00 <	50 <	- -	81	6.63	**4,080**	20 <	- -	- -	- -	- -	- -	- -
	02/28/95	18	10 <	340	10 <	16	130	50 <	- -	66	**6.30**	**3,780**	20 <	- -	- -	- -	- -	- -	- -
	06/07/95	10	10 <	340	10 <	10	680	50 <	- -	73	**6.40**	**881**	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	25	10 <	380	57	10 <	430	50 <	- -	69	6.70	**6,540**	20 <	- -	- -	- -	- -	- -	- -
	12/01/95	14	10 <	310	10 <	10 <	1,600	50 <	- -	52	**6.20**	**4,370**	20 <	- -	- -	- -	- -	- -	- -
	03/13/96	14	24	290	20 <	28	490	100 <	- -	54	6.60	**1,860**	40 <	- -	- -	- -	- -	- -	- -
	06/12/96	21	10 <	290	10 <	13	4,400	50 <	- -	33	**6.40**	**4,430**	1,200	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	10 <	300	10 <	10 <	3,500	50 <	- -	42	**6.37**	**3,690**	27	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	50 <	500 <	50 <	50 <	3,700	250 <	- -	61	**6.49**	**4,350**	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	16	10 <	300	10 <	10 <	550	50 <	- -	40	6.80	**4,100**	20	- -	- -	- -	- -	- -	- -
	05/22/97	57	10 <	300	10 <	10 <	5,000	50 <	- -	32	**6.33**	**4,080**	30 <	- -	- -	- -	- -	- -	- -
	10/16/97	79	10 <	300	14	10 <	4,000	50 <	- -	40	- -	**3,820**	39	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	10 <	330	47	10 <	**7,200**	50 <	- -	28	**6.32**	**4,260**	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	99	5 <	310	7.9	2.5 <	**7,400**	50 <	2,200	28	**5.38**	**4,100**	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	11	320	8	2.5 <	**10,000**	12	2,400	27	**5.40**	**4,000**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	340	5 <	4.5	**9,200**	8.7	2,400	21	6.80	**3,400**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	310	6.1	2.5 <	470	5 <	2,200	19	6.81	**4,400**	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	72	50 <	350	5 <	2.5 <	**13,000**	13	2,100	20	6.65	**4,200**	5.4	- -	- -	- -	- -	- -	- -
	10/19/99	64	50 <	340	5 <	2.5 <	**12,000**	5 <	2,400	21	6.80	**4,200**	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	20 <	310	5 <	2.5 <	**13,000**	14	2,300	20	6.76	**4,000**	NA	2.0	0.0074	53	0.0002 <	**7,400**	0.02
	04/04/00	35	20 <	350	6.5	2.5 <	**12,000**	5 <	2,100	17	8.33	**4,100**	NA	1.6	0.0026	41	0.0002 <	**7,500**	0.04
	08/03/00	38	20 <	350	5.6	2.5 <	**10,000**	5 <	2,000	11	7.17	**4,000**	NA	1.5	0.0065	48	0.0002 <	**7,500**	0.03
	10/17/00	44	20 <	370	5 <	20 <	**11,000**	5 <	2,000	59	6.91	**4,200**	NA	1.7	0.0020 <	58	0.0002 <	**7,500**	0.06
	02/13/01	38	8.7	690	5 <	5.9	**12,000**	3 <	2,100	40	**6.14**	**9,500**	NA	1.8	0.0005	24	0.0002 <	**7,300**	0.10 <
	04/25/01	25	2 J	360	6.6	12	**5,300**	3 <	1,800	52	7.08	**3,700**	NA	3.3	0.0002 J	21	0.0002 <	**5,500**	0.10 <
	08/09/01	38	8.8	450	3 J	4 J	**15,000**	3 <	2,400	24	**6.30**	**3,800**	NA	2.0	0.0005 <	26	0.0002 <	**7,400**	0.010
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		**Yes**	No	No	No	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	NA	**Yes**	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	No	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	**Yes**	No	No	No	**Yes**	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
`rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit . 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G109 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	74	150	10 <	19	150	50 <	- -	120	6.69	**2,350**	100 <	- -	- -	- -	- -	- -	- -
	11/10/94	22	14	130	10 <	10 <	210	50 <	- -	94	**6.28**	**2,030**	25	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	10 <	110	10	10 <	1,400	50	- -	120 <	**6.40**	**1,890**	20 <	- -	- -	- -	- -	- -	- -
	06/06/95	15	10 <	120	10 <	10 <	1,800	50 <	- -	110	**6.30**	**2,910**	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	25	10 <	160	46	10 <	3,100	50 <	- -	140	**6.40**	**4,980**	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	11	12	140	10 <	10 <	1,100	50 <	- -	72	**6.30**	**2,940**	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	19	10 <	100 <	10 <	10 <	2,300	50 <	- -	140	**6.30**	**2,270**	20	- -	- -	- -	- -	- -	- -
	06/12/96	21	10 <	120	10 <	10	2,200	50 <	- -	110	**6.41**	**2,670**	650	- -	- -	- -	- -	- -	- -
	08/29/96	17	10 <	130	10 <	16	190	50 <	- -	99	**6.32**	**2,040**	67	- -	- -	- -	- -	- -	- -
	12/10/96	20	50 <	500 <	50 <	50 <	2,000	250 <	- -	100	**6.35**	**2,550**	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	23	10 <	110	10 <	10 <	2,200	50 <	- -	120	**6.37**	**2,290**	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	10 <	140	10 <	5.2	2,000	50 <	- -	95	**6.20**	**1,960**	110	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	10 <	150	10 <	10 <	2,200	50 <	- -	86	- -	**2,260**	130	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	10 <	120	29	10 <	2,300	50 <	- -	100	**6.17**	**2,200**	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	79	10	140	4.1	5.5	2,600	50 <	8,500	96	**5.48**	**2,500**	5.4	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	9.8	130	5.2	11.0	730	7.8	9,000	99	**5.60**	**2,400**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	120	5 <	7.2	2,500	12	8,600	93	**3.56**	**1,800**	9.9	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	91	6.1	3.1	2,600	5 <	9,400	93	**6.39**	**2,700**	5.9	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	50 <	130	5 <	2.5 <	3,400	10	9,200	99	**5.81**	**2,000**	7.7	- -	- -	- -	- -	- -	- -
	10/19/99	53	50 <	130	5 <	2.5 <	1,600	15	9,200	83	**6.29**	**2,800**	5.4	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	20 <	110	5 <	2.7	370	7.5 <	7,400	67	6.80	**2,300**	NA	0.22	0.0034	26	0.0002 <	**3,900**	0.10
	04/04/00	33	20 <	110	5 <	2.5 <	940	5 <	7,100	72	6.55	**2,400**	NA	0.17	0.002 <	24	0.0002 <	**4,000**	0.07
	08/02/00	39	20 <	150	5 <	2.5 <	2,500	5 <	9,500	98	6.58	**2,700**	NA	1.4	0.0033	39	0.0002 <	**5,000**	0.08
	10/17/00	45	20 <	170	5 <	20 <	1,900	5 <	8,800	150	**6.25**	**2,500**	NA	0.19	0.0020 <	30	0.0002 <	**4,100**	0.081
	02/13/01	40	9.0	330	5 <	5.8	800	3 <	8,200	100	**6.03**	**4,300**	NA	1.0 <	0.0005 <	13	0.0002 <	**4,200**	0.10 <
	04/26/01	39	8.9	560	4 J	11	1,700	3 <	8,300	120	7.52	**2,500**	NA	1.0 <	0.0002 J	12	0.0002 <	**3,700**	0.10 <
	08/08/01	31	10	220	5 <	5 J	1,900	3 <	9,000	85	**6.2**	**2,200**	NA	1.0 <	0.0005 <	11	0.0002 <	**3,900**	0.120
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		**Yes**	No	No	No	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	NA	No*	No	No	No	**Yes**	**Yes**
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	No	No	**Yes**	No*

NOTES:

-- = No data collected.

J = Estimated value. Compound detected below the practical quantitation limit (PQL).

NA = Not applicable.

No* = Detection limit above Upper Confidence Limit.

Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.

1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.

ug/L = Micrograms per liter.

mg/L = Milligrams per liter.

< = Below the method detection limit.

G104 deleted from the monitoring program.

Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.

rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit . 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G110 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	200 <	250	10 <	10 <	50 <	50 <	- -	43	6.83	**3,620**	40 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	31	240	10 <	48	50 <	50 <	- -	16	6.57	**3,030**	20 <	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	20 <	280	20 <	20 <	100 <	100 <	- -	20 <	6.50	**1,990**	40	- -	- -	- -	- -	- -	- -
	06/06/95	10 <	20 <	270	20 <	20 <	350	100 <	- -	40 <	6.50	**3,690**	40 <	- -	- -	- -	- -	- -	- -
	08/29/95	10 <	10 <	280	47	10 <	600	50 <	- -	30 <	6.80	**1,930**	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	14	240	10 <	10 <	660	50 <	- -	20 <	6.90	**3,000**	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	20 <	240	20 <	20 <	830	100 <	- -	40 <	7.10	**3,170**	40 <	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	10 <	230	10 <	14	760	50 <	- -	10 <	6.91	**3,350**	430	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	10 <	260	10 <	10 <	1,200	50 <	- -	12	6.69	**2,460**	20 <	- -	- -	- -	- -	- -	- -
	12/09/96	10 <	50 <	500 <	50 <	50 <	380	250 <	- -	50 <	7.18	**3,010**	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	10 <	280	10 <	10 <	2,100	50 <	- -	10 <	6.84	**3,060**	80	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	10 <	280	10 <	3	2,000	50 <	- -	20 <	6.62	**2,950**	30 <	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	10 <	240	10 <	10 <	1,100	50 <	- -	20 <	- -	- -	120	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	10 <	250	42	10 <	1,200	50 <	- -	20 <	6.86	**3,050**	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	64	22	280	6	3.2	1,900	54	1,300	13	**5.40**	**3,100**	11	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	28	270	6	2.5 <	1,600	16	1,500	5 <	**6.20**	**2,900**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	260	5 <	2.5 <	520	20	1,500	5.4	6.91	**2,300**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	240	7.6	6.3	1,000	5 <	1,600	5 <	7.02	**3,400**	5.1	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	50 <	250	5 <	2.5 <	1,500	17	1,500	5.4	6.67	**3,200**	9.0	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	50 <	280	5 <	2.5 <	1,500	31	1,700	9.0	6.51	**3,000**	7.4	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	24	270	5 <	2.5 <	110	17	1,800	9.0	6.66	**3,300**	NA	0.26	0.0052	200	0.0002 <	**5,900**	0.02
	04/04/00	5 <	21	260	5.2	2.5 <	350	5 <	1,600	5.9	7.00	**3,300**	NA	0.22	0.002 <	180	0.0002 <	**6,000**	0.09
	08/02/00	5 <	20 <	260	5 <	2.5 <	310	5 <	1,700	10 <	6.70	**3,200**	NA	0.29	0.0043	**210**	0.0002 <	**6,000**	0.03
	10/17/00	10 <	23	280	5 <	20 <	470	5 <	1,600	24	**6.33**	**3,300**	NA	0.23	0.0020 <	200	0.0002 <	**6,000**	0.044
	02/13/01	5 <	27	560	5 <	6.8	180	3 <	1,700	48	**6.40**	**7,100**	NA	1.0 <	0.0005 <	**230**	0.0002 <	**5,900**	0.10 <
	04/25/01	5.9	21	270	6.9	11	1,700	3 <	1,500	74	7.50	**3,200**	NA	1.0 <	0.0002 J	170	0.0002 <	**5,300**	0.10 <
	08/09/01	5 <	19	300	4 J	5.2	160	3 <	1,900	25	6.7	**2,800**	NA	1.0 <	0.0005 <	**240**	0.0002 <	**6,000**	0.042
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	**Yes**	No	**Yes**	**Yes**
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	No	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	**Yes**	No	**Yes**	No*

NOTES:

-- = No data collected.

J = Estimated value. Compound detected below the practical quantitation limit (PQL).

NA = Not applicable.

No* = Detection limit above Upper Confidence Limit.

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ug/L = Micrograms per liter.

mg/L = Milligrams per liter.

< = Below the method detection limit.

G104 deleted from the monitoring program.

Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.

'arameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G111 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	200 <	920	10 <	10 <	50 <	50 <	- -	20	7.60	1,540	40 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	52	900	10 <	11	50 <	50 <	- -	10 <	7.36	448	42	- -	- -	- -	- -	- -	- -
	02/27/95	10 <	55	1000	10 <	10 <	50 <	50 <	- -	30 <	6.90	435	20 <	- -	- -	- -	- -	- -	- -
	06/05/95	10 <	72	860	10 <	10 <	50 <	50 <	- -	11	7.70	369	44	- -	- -	- -	- -	- -	- -
	08/29/95	10 <	72	890	22	10 <	50 <	50 <	- -	20 <	7.20	256	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	58	870	10 <	10 <	50 <	50 <	- -	20 <	7.40	195	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	63	860	10 <	10 <	50 <	50 <	- -	20 <	6.70	173	23	- -	- -	- -	- -	- -	- -
	06/05/96	10 <	62	910	10 <	20	50 <	50 <	- -	10 <	7.96	170	41	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	60	890	10 <	10 <	50 <	50 <	- -	10 <	7.20	177	35	- -	- -	- -	- -	- -	- -
	12/09/96	10 <	54	910	50 <	50 <	250 <	250 <	- -	50 <	7.58	144	91	- -	- -	- -	- -	- -	- -
	03/12/97	30 <	80	870	10 <	10 <	50 <	50 <	- -	10 <	7.34	93	20	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	50	770	10 <	10 <	50 <	50 <	- -	20 <	7.43	138	16	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	63	750	10 <	10 <	50 <	50 <	- -	20 <	- -	138	93	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	58	810	13	10 <	50 <	50 <	- -	20 <	7.32	129	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	50 <	63	790	10 <	2.5 <	50 <	50 <	5 <	10 <	6.40	130	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	66	850	5 <	2.5 <	10 <	5 <	6.6	5 <	6.70	120	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	66	830	5 <	4.6	10 <	5 <	5 <	5 <	7.49	120	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	65	780	7.8	14	10 <	5 <	5.7	5 <	7.60	150	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	63	800	5 <	3.6	10 <	7.5 <	22	5 <	7.30	130	5 <	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	62	820	5 <	2.5 <	10 <	5 <	45	5 <	7.16	120	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	62	840	5 <	4.5	10 <	7.5 <	8.2	5 <	7.21	110	NA	0.14	0.002 <	5 <	0.0002 <	500	0.01 <
	04/04/00	5 <	60	830	5 <	22	10 <	5 <	9.3	5 <	7.65	130	NA	0.10 <	0.002 <	5 <	0.0002 <	530	0.01 <
	08/02/00	5 <	66	770	5 <	2.5 <	10 <	5 <	41	10 <	7.33	130	NA	0.10	0.002 <	8.1	0.0002 <	620	0.01 <
	10/17/00	5 <	76	830	5 <	20 <	25 <	5 <	9.9	10 <	7.20	150	NA	0.66	0.002 <	8.8	0.0002 <	550	0.008 <
	02/13/01	5 <	65	870	5 <	7.9	100 <	3 <	50 <	6.5	6.95	140	NA	1.0 <	0.0005 <	2.9	0.0002 <	520	0.10 <
	04/25/01	5 <	71	710	7.8	5	100 <	3 <	100 <	10	8.50	140	NA	1.0 <	0.0005 <	2.8	0.0002 <	480	0.10 <
	08/09/01	5 <	69	830	4 J	5 J	100 <	3 <	10 J	4 J	7.5	140	NA	1.0 <	0.00075	2.7	0.0002 <	580	0.010
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	**Yes**	No	No	No	No	No	No	No	No	NA	No*	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		No	No	**Yes**	**Yes**	No	No	No	No*	No	**Yes**	No	NA	No*	No	No	No	No	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
'ameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G112 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	27	1,200	10 <	10 <	**13,000**	50 <	- -	100 <	6.99	**26,200**	40 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	14	1,200	10 <	12	3,200	50 <	- -	52	6.62	**23,300**	20	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	60 <	1,100	60 <	60 <	2,400	300 <	- -	130	6.30	**19,300**	120 <	- -	- -	- -	- -	- -	- -
	06/05/95	20 <	100 <	1,000	100 <	100 <	2,200	500 <	- -	100 <	6.10	**19,700**	200 <	- -	- -	- -	- -	- -	- -
	08/29/95	10 <	10 <	1,500	50 <	10 <	**17,000**	50 <	- -	56	6.40	**22,100**	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	100 <	100 <	1,500	100 <	10 <	**10,000**	50 <	- -	20 <	6.70	**19,800**	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	200 <	2,000 <	200 <	200 <	**19,000**	1000 <	- -	400 <	6.50	**19,200**	400 <	- -	- -	- -	- -	- -	- -
	06/05/96	10 <	20 <	2,000 <	200 <	200 <	**14,000**	1000 <	- -	200 <	6.63	**23,000**	200 <	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	10 <	1,800	10 <	22	**17,000**	50 <	- -	16	6.52	**18,700**	20 <	- -	- -	- -	- -	- -	- -
	12/09/96	10 <	1,000 <	2,000	1,000 <	1,000 <	**8,800**	5000 <	- -	1000 <	6.67	**20,800**	1,000 <	- -	- -	- -	- -	- -	- -
	03/12/97	30 <	10 <	1,700	10 <	10 <	**9,600**	50 <	- -	10	6.63	**19,000**	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	10 <	2,000	17	6.7	**12,000**	50 <	- -	20 <	6.51	**14,200**	30 <	- -	- -	- -	- -	- -	- -
	10/16/97	71	10 <	**2,100**	18	10 <	**26,000**	50 <	- -	20 <	- -	**20,300**	30 <	- -	- -	- -	- -	- -	- -
	05/12/98	600 <	30 <	2,000	88	30 <	**17,000**	150 <	- -	60 <	6.78	**20,600**	90 <	- -	- -	- -	- -	- -	- -
	09/24/98	160	16	1,300	42	13	2,000	**290**	2,100	88	5.75	**21,000**	9.3	- -	- -	- -	- -	- -	- -
	11/12/98	94	18	1,400	34	11	270	85	2,400	44	5.70	**20,000**	12	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	1,200	5 <	2.5 <	73	**150**	2,100	54	6.84	**22,000**	9.2	- -	- -	- -	- -	- -	- -
	04/14/99	52	50 <	1,200	27	5.8	1,800	**110**	2,100	50	6.85	**21,000**	17	- -	- -	- -	- -	- -	- -
	07/12/99	61	50 <	1,300	17	12	2,500	**110**	2,100	37	6.61	**20,000**	11	- -	- -	- -	- -	- -	- -
	10/19/99	85	50 <	820	26	10	950	100	3,000	43	6.50	**20,000**	11	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	20 <	1,200	25	8	480	98	2,700	48	6.85	**20,000**	NA	0.79	0.025	58	0.0002 <	**28,000**	0.01 <
	04/04/00	5 <	20 <	1,700	33	2.5 <	**20,000**	5 <	1,500	29	7.55	**21,000**	NA	1.0	0.013	50	0.0002 <	**30,000**	0.06
	08/03/00	5 <	20 <	1,600	32	8.6	**5,900**	5 <	3,400	10 <	6.95	**21,000**	NA	0.65	0.044	67	0.0002 <	**30,000**	0.01 <
	10/17/00	11	20 <	1,300	20	130	1,600	10 <	2,700	25	**6.46**	**23,000**	NA	0.54	0.0062	74	0.0002 <	**30,000**	0.029
	02/13/01	5 <	19	**2,600**	5.3	23	2,000	3 <	2,200	47	**6.43**	**54,000**	NA	1.0 <	0.0005 <	99	0.0002 <	**29,000**	0.10 <
	04/25/01	3 J	15	1,500	11	26	**5,500**	3 <	2,100	65	7.63	**20,000**	NA	1.0 <	0.0005 <	43	0.0002 <	**20,000**	0.10 <
	08/09/01	5 <	17	1,600	6.1	17	**7,800**	3 <	3,100	26	6.6	**19,000**	NA	1.0 <	0.0005 <	7.9	0.0002 <	**30,000 H**	0.010
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		No	No	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	**Yes**	No	**Yes**	No*

NOTES:

- - = No data collected.
H = Data analysis was completed outside of hold time.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
ʻameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G113 / R113 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	200 <	**23,000**	10 <	10 <	50 <	50 <	- -	20 <	7.30	**1,770**	40 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	48	**18,000**	10 <	16	50 <	50 <	- -	24	6.64	**1,320**	27	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	15	**16,000**	10 <	10 <	50 <	50 <	- -	10 <	6.40	**1,490**	20 <	- -	- -	- -	- -	- -	- -
	06/05/95	10 <	21	**13,000**	10 <	10 <	50 <	50 <	- -	10 <	6.50	**922**	20 <	- -	- -	- -	- -	- -	- -
	08/29/95	10 <	13	**17,000**	35	10 <	50 <	50 <	- -	20 <	6.80	**1,520**	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	16	**14,000**	10 <	10 <	50 <	50 <	- -	25	6.80	**1,390**	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	20	**12,000**	10 <	10 <	50 <	50 <	- -	95	**6.40**	**963**	20 <	- -	- -	- -	- -	- -	- -
	06/05/96	10 <	20	**17,000**	20 <	20 <	100 <	100 <	- -	25	6.91	**1,780**	20 <	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	10	**19,000**	10 <	10 <	50 <	50 <	- -	58	6.88	**1,310**	20 <	- -	- -	- -	- -	- -	- -
	12/09/96	10 <	50 <	**18,000**	50 <	50 <	250 <	250 <	- -	50 <	6.81	**2,270**	91	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	10 <	**17,000**	10 <	10 <	50 <	50 <	- -	20	6.89	**1,900**	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	10 <	**21,000**	10 <	2.8	17	50 <	- -	20 <	6.56	**2,050**	25	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	10 <	**12,000**	10 <	10 <	50 <	50 <	- -	20 <	- -	**838**	67	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	10 <	**20,000**	31	10 <	50 <	50 <	- -	20 <	6.62	**1,930**	30 <	- -	- -	- -	- -	- -	- -
	09/24/98	50 <	18	**22,000**	3.1	2.5 <	50 <	50 <	4,400	14	**6.02**	**2,100**	8.5	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	70	**4,900**	5 <	2.5 <	270	5 <	1,700	56	6.30	**620**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	**11,000**	5 <	2.5 <	57	5 <	3,600	7.6	6.91	**1,500**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	**13,000**	7.4	9.6	220	5 <	4,300	8	6.75	**2,200**	5.8	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	50 <	**15,000**	5 <	2.5 <	660	8	3,900	7.4	6.58	**1,800**	5 <	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	50 <	**12,000**	5 <	3.1	230	11	3,600	14	6.81	**1,500**	7.3	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	25 <	**9,700**	5 <	3.6	150	7.5 <	1,600	13	6.95	**1,300**	NA	0.18	0.0025	**220**	0.0002 <	**2,600**	0.02
	04/04/00	5.1	20 <	**7,700**	5 <	21	180	5 <	3,000	17	7.02	**1,400**	NA	0.16	0.0020 <	79	0.0002 <	**2,200**	0.01 <
	08/03/00	50 <	20 <	**7,100**	5 <	2.5 <	700	5 <	3,200	10 <	6.88	**1,200**	NA	0.16	0.0026	**270**	0.0002 <	**2,500**	0.01 <
	10/17/00	5 <	23	**7,300**	5 <	20 <	44	5 <	2,300	16	6.71	**1,200**	NA	0.12 <	0.0020 <	**270**	0.0002 <	**2,400**	0.033
	02/13/01	5 <	19	**9,300**	5 <	5 <	140	3 <	2,900	39	6.55	**2,000**	NA	1.0 <	0.0005 <	**270**	0.0002 <	**2,400**	0.10 <
	04/25/01	5 <	20	**12,000**	6.8	5.8	540	3 <	5,200	77	7.63	**1,900**	NA	1.0 <	0.0005 <	110	0.0002 <	**3,200**	0.10 <
	08/08/01	5 <	17	**14,000**	2 J	3 J	1,100	3 <	5,400	23	6.7	**3,400**	NA	1.0 <	0.0005 <	150	0.0002 <	**3,500**	0.017
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	**Yes**	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		No	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	**Yes**	No	**Yes**	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitative limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G113 replaced by R113 on November 4, 1998.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
ʳameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G114 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	260	280	10 <	10 <	50 <	50 <	- -	20 <	7.20	**484**	40 <	- -	- -	- -	- -	- -	- -
	11/10/94	20 <	160	120	10 <	10 <	340	50 <	- -	10 <	7.23	243	48	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	140	170	10 <	10 <	540	50 <	- -	10 <	6.90	244	27	- -	- -	- -	- -	- -	- -
	06/07/95	10 <	120	100	10 <	10 <	230	50 <	- -	10 <	7.00	386	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	160	150	25	10 <	71	50 <	- -	20 <	7.40	**491**	20 <	- -	- -	- -	- -	- -	- -
	12/01/95	10 <	130	110	10 <	10 <	170	50 <	- -	20 <	7.70	306	20 <	- -	- -	- -	- -	- -	- -
	03/13/96	10 <	110	100 <	10 <	10 <	220	50 <	- -	20 <	7.10	287	31	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	120	120	10 <	14	170	50 <	- -	10 <	7.57	**528**	170	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	110	290	10 <	10 <	210	50 <	- -	10 <	7.53	328	20 <	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	140	500 <	50 <	50 <	410	250 <	- -	50 <	7.36	**477**	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	130	110	10 <	10 <	2,100	50 <	- -	10 <	7.46	**497**	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	110	110	10 <	10 <	250	50 <	- -	20 <	7.24	**612**	23	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	130	120	10 <	10 <	520	50 <	- -	20 <	- -	**515**	30 <	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	96	100	20	10 <	360	50 <	- -	20 <	7.39	**624**	30 <	- -	- -	- -	- -	- -	- -
	09/25/98	50 <	84	150	2.5 <	2.5 <	370	50 <	360	10 <	**6.02**	**500**	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	88	120	5 <	2.5 <	110	5 <	410	5 <	**6.20**	**470**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	89	100	5 <	2.5 <	280	5 <	430	5 <	8.45	**670**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	87	140	6.1	9	240	5 <	330	5 <	8.88	**740**	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	75	110	5 <	2.5 <	220	7.5 <	300	5 <	8.45	**530**	5 <	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	75	120	5 <	2.5 <	1,000	5 <	390	5 <	7.36	400	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	96	110	5 <	2.5 <	310	7.5 <	600	5 <	7.23	**610**	NA	0.46	0.0020 <	34	0.0002 <	1,200	0.01 <
	04/04/00	5 <	83	86	5 <	2.5 <	610	5 <	340	5 <	7.35	**640**	NA	0.22	0.0020 <	38	0.0002 <	1,200	0.01 <
	08/03/00	5 <	76	120	5 <	2.5 <	920	5 <	510	10 <	7.12	**500**	NA	0.38	0.0020 <	37	0.0002 <	1,200	0.01 <
	10/17/00	5 <	75	140	5 <	20 <	570	5 <	310	14	7.15	**530**	NA	0.26	0.0020 <	53	0.0002 <	990	0.008 <
	02/13/01	5 <	87	190	5 <	5 <	1,600	3 <	500	17	6.99	**720**	NA	1.0 <	0.0005 <	21	0.0002 <	1,200	0.10 <
	04/25/01	4 J	78	100 <	6.8	4 J	1,300	3 <	390	25	8.11	**550**	NA	1.0 <	0.0005 <	22	0.0002 <	1,000	0.10 <
	08/09/01	5 <	63	140	2 J	3 J	860	3 <	380	6.6	7.5	**450**	NA	1.0 <	0.0005 <	24	0.0002 <	1,000	0.008 J
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	**Yes**	No	**Yes**	No	No	**Yes**	NA	No*	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		No	No	No	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	NA	No*	No	No	No	**Yes**	No*

NOTES:

- - = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
¹rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G115 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/06/94	20 <	200 <	140	10 <	10 <	50 <	50 <	- -	20 <	7.27	**960**	40 <	- -	- -	- -	- -	- -	- -
	11/10/94	20 <	60	150	10 <	15	50 <	50 <	- -	10 <	6.90	**890**	31	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	54	200	10 <	10 <	50 <	50 <	- -	20 <	6.70	**832**	36	- -	- -	- -	- -	- -	- -
	06/07/95	10 <	30	140	10 <	10 <	67	50 <	- -	10 <	7.00	**1,070**	20 <	- -	- -	- -	- -	- -	- -
	08/30/95	10 <	31	180	28	10 <	50 <	50 <	- -	20 <	7.20	**903**	20 <	- -	- -	- -	- -	- -	- -
	12/01/95	10 <	39	130	10 <	10 <	100	50 <	- -	20 <	7.20	**866**	20 <	- -	- -	- -	- -	- -	- -
	03/13/96	10 <	22	100 <	10 <	10 <	50 <	50 <	- -	20 <	7.20	**666**	20 <	- -	- -	- -	- -	- -	- -
	06/12/96	10 <	18	130	10 <	16	50 <	50 <	- -	10 <	6.98	**667**	460	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	23	260	10 <	10 <	50 <	50 <	- -	12	7.02	**584**	19	- -	- -	- -	- -	- -	- -
	12/10/96	10 <	50 <	500 <	50 <	50 <	250 <	250 <	- -	50 <	7.02	**592**	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	20	120	10 <	10 <	50 <	50 <	- -	10 <	7.02	**595**	20	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	20	140	10 <	10 <	44	50 <	- -	20 <	6.93	**741**	320	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	21	140	10 <	10 <	50 <	50 <	- -	20 <	- -	**555**	31	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	19	120	18	10 <	50 <	50 <	- -	20 <	6.84	**576**	30 <	- -	- -	- -	- -	- -	- -
	09/25/98	50 <	28	170	5.7	2.5 <	50 <	50 <	440	10 <	7.37	**510**	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	28	150	5 <	2.5 <	10 <	5 <	200	5 <	**5.80**	**480**	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	50 <	130	5 <	2.9	11	5 <	55	5 <	7.09	**590**	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	110	6.6	12	10 <	5 <	130	5 <	7.22	**560**	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	50 <	120	5 <	2.5 <	10 <	8 <	270	5 <	7.10	**590**	5 <	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	50 <	140	5 <	3.5	10 <	5 <	440	5.1	7.29	**610**	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	29	140	9.5	2.5 <	10 <	7.5 <	45	5 <	7.24	**630**	NA	0.10 <	0.0020 <	22	0.0002 <	1,200	0.02
	04/04/00	5 <	23	97	5 <	2.5 <	10 <	5 <	19	5 <	7.97	**670**	NA	0.10 <	0.0020 <	21	0.0002 <	1,200	0.02
	08/03/00	5 <	23	130	5 <	2.5 <	10 <	5 <	300	10 <	7.02	**590**	NA	0.10 <	0.0020 <	22	0.0002 <	1,200	0.01 <
	10/17/00	5 <	25	130	5 <	20 <	25 <	5 <	98	13	7.28	**510**	NA	0.12 <	0.0020 <	27	0.0002 <	970	0.01
	02/13/01	5 <	25	150	5 <	5 <	100 <	3 <	63	16	7.35	**680**	NA	1.0 <	0.0005 <	14	0.0002 <	1,200	0.10 <
	04/25/01	3 J	26	140	7.2	7.6	100 <	3 <	100 <	22	8.19	**580**	NA	1.0 <	0.0005 <	11	0.0002 <	1,100	0.10 <
	08/09/01	5 <	21	210	2 J	5 <	100 <	3 <	250	8.4	7.4	**650**	NA	1.0 <	0.0005 <	12	0.0002 <	1,000	0.012
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	No	No	**Yes**	No	No	**Yes**	NA	No*	No	No	No	**Yes**	No
Confidence Limit Exceeded in Q2, 2001		No	No	No	**Yes**	No	No	No	No*	**Yes**	**Yes**	**Yes**	NA	No*	No	No	No	**Yes**	No*

NOTES:

- - = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
'rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G116 Background	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/07/94	20 <	200 <	110	10 <	10 <	160	50 <	- -	20 <	7.76	82.2	20 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	54	110	10 <	10 <	50 <	50 <	- -	10 <	7.43	34.2	34	- -	- -	- -	- -	- -	- -
	02/27/95	10 <	72	220	10 <	10 <	50 <	50 <	- -	10 <	6.90	60.3	20 <	- -	- -	- -	- -	- -	- -
	06/05/95	10 <	65	190	10 <	10 <	61	50 <	- -	16	7.50	62.4	20 <	- -	- -	- -	- -	- -	- -
	08/29/95	10 <	67	200	21	10 <	50 <	50 <	- -	20 <	7.20	137	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	76	210	10 <	10 <	50 <	50 <	- -	20 <	7.20	57.3	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	69	220	10 <	10 <	50 <	50 <	- -	20 <	6.70	77.1	20 <	- -	- -	- -	- -	- -	- -
	06/05/96	10 <	61	240	10 <	12	50 <	50 <	- -	10 <	8.16	74.1	10 <	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	59	180	10 <	10 <	50 <	50 <	- -	10 <	7.47	64.1	20	- -	- -	- -	- -	- -	- -
	12/09/96	10 <	59	500 <	50 <	50 <	250 <	250 <	- -	50 <	7.81	68.2	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	70	190	10 <	10 <	50 <	50 <	- -	10 <	7.73	61.6	20 <	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	78	210	10 <	10 <	95	50 <	- -	20 <	7.36	62.0	16	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	50	120	10 <	10 <	50 <	50 <	- -	20 <	- -	59.6	57	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	69	180	11	10 <	190	50 <	- -	20 <	7.44	61.6	57	- -	- -	- -	- -	- -	- -
	09/24/98	50 <	53	130	2.5 <	2.5 <	50 <	50 <	5 <	10 <	**6.36**	61	5 <	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	55	130	5 <	2.5 <	10 <	5 <	5 <	5 <	6.50	60	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	66	200	5 <	2.5 <	22	5.3	5 <	5 <	7.56	64	5 <	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	50 <	200	7	12	35	5 <	10	5 <	7.59	64	5 <	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	56	130	5 <	2.5 <	10 <	7.5 <	11	5 <	6.93	61	6	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	67	180	5 <	2.5 <	10 <	5 <	10	5 <	7.08	59	5 <	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	68	190	5 <	2.5 <	17	7.5 <	16	5 <	7.23	65	NA	0.10 <	0.0020 <	16	0.0002 <	380	0.01 <
	04/04/00	5 <	76	200	5 <	2.5 <	10 <	5 <	5 <	14	8.05	120	NA	0.10 <	0.0020 <	14	0.0002 <	480	0.01 <
	08/02/00	5 <	74	200	5 <	2.5 <	10	5 <	540	10 <	7.55	60	NA	0.13	0.0020 <	23	0.0002 <	440	0.01 <
	10/17/00	5 <	75	200	5 <	20 <	37	5 <	8.2	10 <	7.18	73	NA	0.12 <	0.0020 <	19	0.0002 <	410	0.017
	02/13/01	5 <	77	250	5 <	5 <	190	3 <	50 <	7.5	7.35	67	NA	1.0 <	0.0005 <	12	0.0002 <	400	0.10 <
	04/24/01	5 <	81	430	5.9	5.1	100 <	2 J	100 <	9.9	- -	60	NA	1.0 <	0.0006	13	0.0002 <	410	0.10 <
	08/08/01	5 <	66	270	3 J	5 <	100 <	3 <	15 <	3 J	7.4	59	NA	1.0 <	0.0005 <	21	0.0002 <	410	- -
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	No	No	No*	No	No	No	NA	No*	No	No	No	No	NA
Confidence Limit Exceeded in Q2, 2001		No	No	No	No	No	No	No	No*	No	- -	No	NA	No*	No	No	No	No	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
rameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G117 Background	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	07/07/94	20 <	200 <	270	10 <	10 <	50 <	50 <	- -	20 <	7.59	26.8	20 <	- -	- -	- -	- -	- -	- -
	11/11/94	20 <	110	350	10 <	10 <	50 <	50 <	- -	10 <	7.44	22.5	37	- -	- -	- -	- -	- -	- -
	02/28/95	10 <	59	270	10 <	10 <	95	50 <	- -	10 <	6.80	145.0	20 <	- -	- -	- -	- -	- -	- -
	06/05/95	10 <	50	440	20 <	20 <	100 <	100 <	- -	20 <	7.20	96.0	40 <	- -	- -	- -	- -	- -	- -
	08/29/95	10 <	100	300	19	10 <	50 <	50 <	- -	20 <	7.10	44.4	20 <	- -	- -	- -	- -	- -	- -
	11/30/95	10 <	100	370	10 <	10 <	50 <	50 <	- -	20 <	6.80	41.8	20 <	- -	- -	- -	- -	- -	- -
	03/12/96	10 <	79	300	10 <	10 <	50 <	50 <	- -	20 <	6.80	80.4	25	- -	- -	- -	- -	- -	- -
	08/29/96	10 <	98	300	10 <	12	50 <	50 <	- -	10 <	7.18	46.9	26	- -	- -	- -	- -	- -	- -
	12/09/96	10 <	82	50 <	50 <	50 <	250 <	250 <	- -	50 <	7.68	47.1	50 <	- -	- -	- -	- -	- -	- -
	03/12/97	10 <	70	170	10 <	10 <	50 <	50 <	- -	10 <	7.52	48.7	30	- -	- -	- -	- -	- -	- -
	05/22/97	200 <	72	200	10 <	10 <	22	50 <	- -	20 <	7.32	51.0	26	- -	- -	- -	- -	- -	- -
	10/16/97	200 <	90	290	10 <	10 <	50 <	50 <	- -	20 <	- -	36.6	54	- -	- -	- -	- -	- -	- -
	05/12/98	200 <	83	180	12	10 <	50 <	51	- -	20 <	7.33	55.9	30 <	- -	- -	- -	- -	- -	- -
	09/25/98	50 <	64	160	2.5 <	2.5 <	50 <	50 <	5.8	10 <	7.05	53	6.7	- -	- -	- -	- -	- -	- -
	11/12/98	50 <	72	190	5 <	7.5	10 <	5 <	5.3	5 <	6.60	55	5 <	- -	- -	- -	- -	- -	- -
	02/23/99	50 <	57	140	5 <	5.1	10 <	5 <	5 <	5 <	7.34	58	11	- -	- -	- -	- -	- -	- -
	04/14/99	50 <	66	140	5.7	13	10 <	5 <	9.7	5 <	7.37	61	12	- -	- -	- -	- -	- -	- -
	07/12/99	50 <	63	140	5 <	2.5 <	10 <	7.5 <	5 <	5 <	7.21	52	8.6	- -	- -	- -	- -	- -	- -
	10/19/99	50 <	69	140	5 <	2.5 <	10 <	5 <	5 <	5 <	7.25	56	7.0	- -	- -	- -	- -	- -	- -
	01/10/00	50 <	84	210	5 <	2.5 <	14	7.5 <	20	5 <	7.56	48	NA	0.10 <	0.0020 <	20	0.0002 <	410	0.01 <
	04/04/00	5 <	87	220	5 <	2.5 <	10 <	5 <	5 <	5 <	7.52	61	NA	0.10 <	0.0020 <	19	0.0002 <	430	0.01 <
	08/03/00	5 <	63	150	5 <	2.5 <	10 <	5 <	5 <	10 <	7.38	67	NA	0.10 <	0.0020 <	37	0.0002 <	490	0.02
	10/17/00	5 <	77	190	5 <	20 <	25 <	5 <	5 <	10 <	7.13	62	NA	0.12 <	0.0020 <	30	0.0002 <	440	0.008 <
	02/13/01	5 <	68	170	5 <	5 <	100 <	3 <	50 <	7.7	6.98	50	NA	1.0 <	0.0005 <	26	0.0002 <	450	0.10 <
	04/25/01	5.2	73	180	7	6.2	100 <	3 <	100 <	8.6	8.31	55	NA	1.0 <	0.0005 <	24	0.0002 <	420	0.10 <
	08/09/01	5 <	75	210	3 J	5 <	100 <	3 <	15 <	3 J	7.5	37	NA	1.0 <	0.0005 <	19	0.0002 <	420	0.010 <
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	No	No	No	No	No	No*	No	No	No	NA	No*	No	No	No	No	No
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	No	No	No	No	No	No*	No	**Yes**	No	NA	No*	No	No	No	No	No*

NOTES:

-- = No data collected.
J = Estimated value. Compound detected below the practical quantitation limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
Parameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

TABLE 2

Quarterly Landfill Compliance Monitoring Well Data Compared to Class II Groundwater Standards and the Confidence Limits of the Pooled Background Wells

Quarter 3, 2001

Permit No. 1993-004-DE/OP (Post-Closure)

Supplemental Permit No. 2000-032-SP

ILD 005078126 -- Douglas County -- 0418080002

Equistar Chemicals, LP / Tuscola, Illinois

Monitoring Well G118 Downgradient	Sample Dates	Arsenic-d 01000 ug/L	Barium-d 01005 ug/L	Boron-d 01020 ug/L	Chromium-d 01030 ug/L	Copper-d 01040 ug/L	Iron-d 01046 ug/L	Lead-d 01049 ug/L	Manganese-d 01056 ug/L	Nickel-d 01065 ug/L	pH 00400 STD units	Sulfate-d 00946 mg/L	Zinc-d 01092 ug/L	Ammonia (N)-d 00608 mg/L	Cadmium-d 01025 mg/L	Chloride-d 00941 mg/L	Mercury-d 71890 mg/L	TDS-d 70300 mg/L	TOX-t 78115 mg/L
	01/10/00	50 <	59	**7,700**	5.0 <	2.5 <	140	7.5 <	5.0 <	5.0 <	7.13	310	NA	0.10 <	0.0020 <	16	0.0002 <	890	0.02
	04/04/00	5 <	70	**8,500**	5.0 <	2.5 <	2,300	5 <	290	5.2	7.98	310	NA	0.42	0.0020 <	10	0.0002 <	820	0.01 <
	08/02/00	5 <	65	**3,600**	5.0 <	2.5 <	10	5 <	140	10 <	7.59	130	NA	0.22	0.0020 <	14	0.0002 <	630	0.01 <
	10/17/00	5 <	81	1,800	5 <	20 <	30	5 <	50	10 <	7.32	85	NA	0.12 <	0.0020 <	19	0.0002 <	500	0.008 <
	02/13/01	5 <	92	**2,900**	5 <	5 <	100 <	3 <	210	9.1	7.07	99	NA	1.0 <	0.0005 <	26	0.0002 <	460	0.10 <
	04/26/01	13	90	**2,700**	5.2	3 J	100 <	3 <	130	6.3	**9.09**	99	NA	1.0 <	0.0005 <	8.5	0.0002 <	450	0.10 <
	08/09/01	5 <	91	**2,100**	3 J	2 J	180	3 <	310	4 J	7.30	73	NA	1.0 <	0.0005 <	7.9	0.0002 <	530	- -
Class II GW Standard		200	2,000	2,000	1,000	650	5,000	100	10,000	2,000	6.5 / 9.0	400	10,000	no standard	0.05	200	0.01	1,200	no standard
Upper Confidence Limit[1]		5.0	123.65	473.41	7.0	20.0	154.95	5.0	12.25	16.27	8.17	149.01	40.92	0.12	2.0	42.3	0.2	508.7	0.021
Lower Confidence Limit[1]		NA	NA	NA	NA	NA	NA	NA	NA	NA	6.49	NA	NA	NA	NA	NA	NA	NA	NA
Confidence Limit Exceeded in Q3, 2001		No	No	**Yes**	No	No	**Yes**	No	**Yes**	No	No	No	NA	No*	No	No	No	**Yes**	NA
Confidence Limit Exceeded in Q2, 2001		**Yes**	No	**Yes**	No	No	No	No	**Yes**	No	**Yes**	No	NA	No*	No	No	No	No	No*

NOTES:

- - = No data collected.
J = Estimated value. Compound detected below the practical quantitative limit (PQL).
NA = Not applicable.
No* = Detection limit above Upper Confidence Limit.
Bold-face value in a shaded box indicates that the concentration exceeds the Class II groundwater standard for that parameter.
1 = Confidence limits as determined using the method provided in Attachment B to Supplemental Permit No. 2000-032-SP.
ug/L = Micrograms per liter.
mg/L = Milligrams per liter.
< = Below the method detection limit.
G104 deleted from the monitoring program.
Class II groundwater quality standards from Subpart D of 35 Ill. Adm. Code Part 620.
Parameters with 100% of results below the method detection limit (MDL), during the first year of sampling for each individual parameter in monitoring wells G116 and G117, have an Upper Confidence Limit (UCL) equal to the applicable PQL contained in Attachment A of Supplemental Permit No. 2000-032-SP. These parameters include arsenic, cadmium, chromium, copper, lead and mercury.

APPENDIX M-3

ASSESSMENT MONITORING WELLS – VOC DATA

Organic Parameter Data for Landfill Assessment Monitoring Wells G119 to G309 Versus Landfill Leachate Concentrations

ILD 005078126 -- Douglas County -- 0418080002
Millennium Petrochemicals, Inc. / Tuscola, Illinois

Date	Storet Code	Compounds	Unit	Assessment Monitoring Wells														Leachate Wells[1]				
				Shallow Wells							Intermediate Wells				Deep Wells			May 12-13, 1999				
				G119 4/3/00	G120 4/3/00	G121 8/2/00	G122 8/2/00	G123 4/3/00	G124 NA	G125 4/3/00	G200 4/3/00	G201 4/3/00	G206 4/3/00	G209 4/3/00	G300 4/3/00	G306 4/3/00	G309 4/3/00	Well L3	Well L4	Well L5	Well L6	Well L7
Volatile Organic Compounds																						
	34506	1,1,1-Trichloroethane, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**6.9**	**20**	<0.5	<0.5	**18**
	34511	1,1,2-Trichloroethane, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
	34501	1,1-Dichloroethene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
	34551	1,2,4-Trichlorobenzene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
	77222	1,2,4-Trimethylbenzene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**6**	**14**	**2.2**	<0.5	<0.5
	34531	1,2-Dichloroethane, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
	77226	1,3,5-Trimethylbenzene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**1.3**	**2.9**	**0.58**	<0.5	<0.5
	34571	1,4-Dichlorobenzene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.2	<0.2	**0.3**	<0.2	<0.2
	77356	4-Isopropyltoluene	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**1.1**	**0.94**	<0.5	<0.5	<0.5
	34030	Benzene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**4.9**	**20**	**11**	<0.5	<0.5
	34301	Chlorobenzene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
	34311	Chloroethane, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	<0.5	<0.5	**3.3**
	77093	cis 1,2-Dichloroethene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	**0.70**	**80**	<0.5	<0.5
	78113	Ethylbenzene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	**0.56**	**2.3**	<0.5	<0.5
	34696	Naphthalene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**1.3**	**1.4**	**0.52**	<0.5	<0.5
	34475	Tetrachloroethene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	**0.94**	<0.5	<0.5
	34010	Toluene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.3	**2.2**	**7.3**	<0.5	<0.5
	34546	trans 1,2-Dichloroethene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	**0.86**	<0.5	<0.5
	39180	Trichloroethene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.5	<0.5	**1.9**	<0.2	<0.2
	39175	Vinyl Chloride, total	ug/L	<10.0	<10.0	<10.0	<10.0	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<0.5	<0.5	<0.5	<0.5	<0.5
	81551	Xylene, total	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<3.6	**6.6**	**2.7**	<0.5	<0.5
Total Organic Carbon (TOC)																						
02/01/00	680	Carbon, total organic	mg/L						**1.8**													
04/03/00	680	Carbon, total organic	mg/L	<1.0	<1.0	NM	NM	**1.8**	NA	<1.0	**9.1**	**3.9**	**10**	**4.1**	**13**	**21**	<1.0	**45**	**190**	*insufficient sample for analysis*		
08/02/00	680	Carbon, total organic	mg/L	**1.3**	**1.5**	<1.0	**1.6**	**1.5**	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Total Organic Halogens (TOX)																						
02/01/00	78115	Halogen, Total Organic	ug/L	- -	- -	- -	- -	- -	<10.0	**20**	<10.0	**20**		<10.0	<10.0	<10.0	<10.0	<10.0	**220**	*insufficient sample for analysis*		
02/07/00	78115	Halogen, Total Organic	ug/L										<10.0									
04/03/00	78115	Halogen, Total Organic	ug/L	<10.0	<10.0	NM	NM	<10.0	NA	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	- -	- -	- -	- -	- -
08/02/00	78115	Halogen, Total Organic	ug/L	<10.0	**20**	<10.0	<10.0	<10.0	NA	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

NOTES:
mg/L = Milligrams per liter
ug/L = Micrograms per liter
NA = Not applicable; well not required to be monitored for organic compounds.
-- = Not sampled
< = Below the method detection limit indicated
[1] = Leachate data from leachate wells located in the landfills. Well number indicates in which landfill area the leachate well is located (L3 is located in landfill area 3).

APPENDIX M-4

ASSESSMENT MONITORING WELLS – INORGANIC DATA

Inorganic Parameter Data for Landfill Assessment Monitoring Wells G119 to G309 Versus Landfill Leachate Concentrations

ILD 005078126 -- Douglas County -- 041808002
Millennium Petrochemicals, Inc. / Tuscola, Illinois

Storet Code	Inorganic Parameter	Unit	Class 2 GW Standard	Assessment Monitoring Wells — Shallow Wells — G119 4/3/00	G119 8/2/00	G120 4/3/00	G120 8/2/00	G121 8/2/00	G122 8/2/00	G123 4/3/00	G123 8/2/00	G124 2/1/00	G124 4/3/00	G125 2/1/00	G125 4/3/00
00410	Alkalinity, total (as CACO3)	mg/L	NA	342	NM	428				282		NM	NM	360	360
00608	Ammonia as Nitrogen, dissolved	mg/L	NA	0.12	0.2	0.32	0.11	<0.10	<0.10	0.21	<0.10	0.14	NM	0.12	<0.10
01095	Antimony, dissolved	ug/L	24	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NM	<5.0	<5.0
01000	Arsenic, dissolved	ug/L	200	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<50.0	<5.0	<50.0	<5.0
01005	Barium, dissolved	ug/L	2,000	90	77	71	65	56	52	45	47	110	93	60	60
01010	Beryllium, dissolved	ug/L	500	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	NM	<4.0	<4.0
01020	Boron, dissolved	ug/L	2,000	150	160	290	140	120	120	150	170	190	170	85	82
01025	Cadmium, dissolved	ug/L	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
00915	Calcium, dissolved	mg/L	NA	104.46	NM	139.5	NM	NM	NM	125.89	NM	NM	120.74	110	115.24
00941	Chloride, dissolved	mg/L	200	18	22	19	37	25	110	28	33	70	74	32	34
01030	Chromium, dissolved	ug/L	1,000	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01036	Cobalt, dissolved	ug/L	1,000	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	NM	<10.0	<10.0
01046	Iron, dissolved	ug/L	5,000	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	26	<10.0	<10.0	<10.0
01049	Lead, dissolved	ug/L	100	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.5	<5.0	<7.5	<5.0
00925	Magnesium, dissolved	mg/L	NA	45.6	NM	65.0	NM	NM	NM	59.8	NM	NM	56.2	46.0	56.2
01056	Manganese, dissolved	ug/L	10,000	130	160	290	190	34	32	130	60	74	8.2	<5.0	<5.0
71890	Mercury, dissolved	ug/L	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NM	<0.2	<0.2
01065	Nickel, dissolved	ug/L	2,000	<5.0	<10.0	8.7	<10.0	<10.0	<10.0	<5.0	<10.0	<5.0	<5.0	<5.0	<5.0
00400	pH (field)	STD	6.5 / 9.0	7.13	7.13	7.20	7.08	7.08	7.03	7.24	7.14	7.21	7.35	7.21	7.21
00935	Potassium, dissolved	mg/L	NA	5.7	NM	14.5	NM	NM	NM	7.7	NM	NM	8.0	3.1	3.3
01145	Selenium, dissolved	ug/L	50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NM	<5.0	<5.0
00930	Sodium, dissolved	mg/L	NA	26.5	NM	56.7	NM	NM	NM	28.3	NM	NM	24.9	39.0	49.4
00946	Sulfate, dissolved	mg/L	400	150	140	290	190	160	280	270	230	180	140	170	200
01057	Thallium, dissolved	ug/L	20	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	NM	<10.0	<10.0
70300	Total Dissolved Solids	mg/L	1,200	550	610	820	720	670	950	710	750	700	610	650	680
01090	Zinc, dissolved	ug/L	10,000	5.79	NM	9.36	NM	NM	NM	2.72	NM	<5.0	13.65	<5.0	1.63

NOTES:
mg/L = Milligrams per liter
NM = Not measured
ug/L = Micrograms per liter
< = Below the method detection limit indicated
[1] = Leachate data from leachate wells located in the landfills. Well number indicates in which landfill area the leachate well is located (L3 is located in landfill area 3).
Bolded and shaded cells indicate a parameter that exceeds Class 2 groundwater standard.

Inorganic Parameter Data for Landfill Assessment Monitoring Wells G119 to G309 Versus Landfill Leachate Concentrations

ILD 005078126 -- Douglas County -- 041808002
Millennium Petrochemicals, Inc. / Tuscola, Illinois

Storet Code	Inorganic Parameter	Unit	Class 2 GW Standard	Assessment Monitoring Wells							
				Intermediate Wells							
				G200		G201		G206		G209	
				2/1/00	4/3/00	2/1/00	4/3/00	2/1/00	4/3/00	2/1/00	4/3/00
00410	Alkalinity, total (as CACO3)	mg/L	NA	380	412	310	342	340	374	430	410
00608	Ammonia as Nitrogen, dissolved	mg/L	NA	1.6	<0.10	3	3.4	0.46	0.81	2.7	2.2
01095	Antimony, dissolved	ug/L	24	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01000	Arsenic, dissolved	ug/L	200	<50.0	<5.0	<50.0	<5.0	<50.0	<5.0	<50.0	<5.0
01005	Barium, dissolved	ug/L	2,000	130	130	190	180	120	86	150	170
01010	Beryllium, dissolved	ug/L	500	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
01020	Boron, dissolved	ug/L	2,000	**2,200**	2,000	**2,600**	**2,300**	1,200	910	**2,200**	**2,200**
01025	Cadmium, dissolved	ug/L	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
00915	Calcium, dissolved	mg/L	NA	67	72.659	58	58.158	54	8.568	57	56.405
00941	Chloride, dissolved	mg/L	200	<5.0	<5.0	12	12	<5.0	11	<5.0	<5.0
01030	Chromium, dissolved	ug/L	1,000	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01036	Cobalt, dissolved	ug/L	1,000	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
01046	Iron, dissolved	ug/L	5,000	210	19	550	370	120	<10.0	250	640
01049	Lead, dissolved	ug/L	100	<7.5	<5.0	<7.5	<5.0	<7.5	<5.0	<7.5	<5.0
00925	Magnesium, dissolved	mg/L	NA	32.0	35.3	31.0	32.3	30.0	5.3	32.0	32.1
01056	Manganese, dissolved	ug/L	10,000	220	170	34	48	240	<5.0	140	110
71890	Mercury, dissolved	ug/L	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
01065	Nickel, dissolved	ug/L	2,000	<5.0	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
00400	pH (field)	STD	6.5 / 9.0	7.42	7.51	7.99	8.71	7.42	**10.6**	7.49	8.40
00935	Potassium, dissolved	mg/L	NA	5.4	6.1	8.0	7.9	6.5	30.5	7.7	6.9
01145	Selenium, dissolved	ug/L	50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
00930	Sodium, dissolved	mg/L	NA	61.0	74.0	68.0	82.2	51.0	107.1	66.0	65.9
00946	Sulfate, dissolved	mg/L	400	73	78	110	100	27	16	28	18
01057	Thallium, dissolved	ug/L	20	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
70300	Total Dissolved Solids	mg/L	1,200	500	510	480	480	390	370	460	420
01090	Zinc, dissolved	ug/L	10,000	<5.0	3.53	<5.0	2.8	11	0.72	<5.0	3.46

NOTES:
mg/L = Milligrams per liter
NM = Not measured
ug/L = Micrograms per liter
< = Below the method detection limit indicated
[1] = Leachate data from leachate wells located in the landfills. Well number indicates in which landfill area the leachate well is located (L3 is located in landfill area 3).
Bolded and shaded cells indicate a parameter that exceeds Class 2 groundwater standard.

Inorganic Parameter Data for Landfill Assessment Monitoring Wells G119 to G309 Versus Landfill Leachate Concentrations

ILD 005078126 -- Douglas County -- 041808002
Millennium Petrochemicals, Inc. / Tuscola, Illinois

Storet Code	Inorganic Parameter	Unit	Class 2 GW Standard	Assessment Monitoring Wells — Deep Wells — G300 2/1/00	G300 4/3/00	G306 2/1/00	G306 4/3/00	G309 2/1/00	G309 4/3/00	Leachate Wells[1] Unfiltered Leachate May 12 - 13, 1999 Well L3	Well L4
00410	Alkalinity, total (as CACO3)	mg/L	NA	390	400	480	458	620	594	NM	NM
00608	Ammonia as Nitrogen, dissolved	mg/L	NA	2.7	2.8	2.4	2.4	6.4	6.7	40	80
01095	Antimony, dissolved	ug/L	24	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.5	6.2
01000	Arsenic, dissolved	ug/L	200	<50.0	9.9	<50.0	6.3	<50.0	9.3	82	320
01005	Barium, dissolved	ug/L	2,000	110	120	130	140	140	170	66	96
01010	Beryllium, dissolved	ug/L	500	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	68	46
01020	Boron, dissolved	ug/L	2,000	**2,400**	**2,400**	**2,600**	**2,600**	**2,600**	**2,500**	840	2,200
01025	Cadmium, dissolved	ug/L	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.4	240
00915	Calcium, dissolved	mg/L	NA	49	53.509	74	77.893	77	80.785	530	560
00941	Chloride, dissolved	mg/L	200	<5.0	9.6	10	17	<5.0	5.7	NM	NM
01030	Chromium, dissolved	ug/L	1,000	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	62	2,000
01036	Cobalt, dissolved	ug/L	1,000	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	50	350
01046	Iron, dissolved	ug/L	5,000	170	590	1,200	2,700	**6,700**	**6,800**	360,000	680,000
01049	Lead, dissolved	ug/L	100	<7.5	<5.0	<7.5	<5.0	<7.5	<5.0	11	77
00925	Magnesium, dissolved	mg/L	NA	20.0	22.1	20.0	20.5	41.0	42.6	380	470
01056	Manganese, dissolved	ug/L	10,000	100	150	85	77	170	160	11,000	49,000
71890	Mercury, dissolved	ug/L	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	0.34
01065	Nickel, dissolved	ug/L	2,000	<5.0	<5.0	5.6	<5.0	<5.0	<5.0	150	970
00400	pH (field)	STD	6.5 / 9.0	7.46	8.97	7.39	**9.72**	7.31	8.58	NM	NM
00935	Potassium, dissolved	mg/L	NA	3.4	3.9	6.2	6.2	3.7	4.1	360	1,000
01145	Selenium, dissolved	ug/L	50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	15	16
00930	Sodium, dissolved	mg/L	NA	82.0	84.3	96.0	102.1	86.0	89.1	300	860
00946	Sulfate, dissolved	mg/L	400	8.1	7.9	15	17	<5.0	<5.0	4,300	6,500
01057	Thallium, dissolved	ug/L	20	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	2.6	6.5
70300	Total Dissolved Solids	mg/L	1,200	420	380	560	530	620	580	7,700	16,000
01090	Zinc, dissolved	ug/L	10,000	38	1.57	<5.0	2.15	<5.0	4.07	280	2,600

Class I 150 ppb

NOTES:
mg/L = Milligrams per liter
NM = Not measured
ug/L = Micrograms per liter
< = Below the method detection limit indicated
[1] = Leachate data from leachate wells located in the landfills. Well number indicates in which landfill area the leachate well is located (L3 is located in landfill area 3).
Bolded and shaded cells indicate a parameter that exceeds Class 2 groundwater standard.

Clayton GROUP SERVICES

APPENDIX N

SCOPE OF WORK
ADDITIONAL RCRA FACILITY INVESTIGATION

SCOPE OF WORK
Additional RCRA Facility Investigation

Millennium Petrochemicals, Inc.
Tuscola, Illinois
ILD005078126

The recently completed RFI identified the need for additional data with respect to the evaluation of Kaskaskia River sediment and groundwater in the study area. Specifically, additional river sediment sampling is needed in the outlet channel from the facility and at the furthest downstream sediment sampling location (SS04), an additional shallow monitoring well needs to be in stalled in the area of MW03S, an additional deep monitoring well needs to be installed on the east side of landfill areas 1 and 2, another round of groundwater sampling is needed, and residential wells in the area need to be sampled.

ADDITIONAL KASKASKIA RIVER SEDIMENT SAMPLING

The sediment sample collected from the outlet channel from the facility to the Kaskaskia River (SS06) contains acenaphthene, fluorene, and pyrene above USEPA Region IV sediment screening levels. Furthermore, the total low molecular weight PAHs found in the furthest downstream sediment sample (SS04 below the railroad trestle) was above the USEPA Region IV screening level for total low molecular weight PAHs. Therefore, it is proposed to collect additional sediment samples in these two areas. A series of 6 to 10 sediment samples will be collected along the outlet channel, and an additional 6 to 10 sediment samples will be collected in the area of SS04 (upstream and downstream). The sampling will be conducted in the same manner as the prior RFI river sediment sampling (as outlined in the October 27, 2000, RFI Work Plan). However, since the only issue is with PAHs, the samples will be analyzed for PAHs only.

ADDITIONAL SHALLOW WELL

Monitoring well MW03S was the only well in the shallow glacial drift pathway where potential VOCs of concern were detected. Benzene, chloroform, cis-1,2-dichloroethene, and vinyl chloride were detected at concentrations above screening levels. To further evaluate this area, it is proposed to install an additional shallow monitoring well in this area. The well will be installed and sampled in the same manner as the other RFI monitoring wells (as outlined in the October 27, 2000, RFI Work Plan).

ADDITIONAL DEEP WELL

The RFI has provided supporting data concerning the groundwater divide located on the east side of the site within the shallow glacial drift pathway. Data collected during the RFI suggest that the divide may extend to the deep glacial drift pathway; however, there is a lack of data points on the east side of the divide (into the deep glacial drift pathway) to confirm this. It is proposed to install an additional deep monitoring well on the east side of landfill areas 1 and 2. The analysis of groundwater samples from this well will also allow for the further evaluation of the occurrence of boron in the groundwater. The well will be installed and sampled in the same manner as the other RFI monitoring wells (as outlined in the October 27, 2000, RFI Work Plan).

ADDITIONAL ROUND OF GROUNDWATER SAMPLING

Some of the potential contaminants of concern identified in the groundwater were detected during one sampling event but not the other. Therefore, to obtain a better understanding of groundwater conditions, it is proposed to complete an additional round (third round) of groundwater sampling from the RFI monitoring wells. This sampling event would occur after the additional shallow and deep monitoring wells have been installed and developed. The sampling event will be coordinated with the sampling of the landfill monitoring wells that are being sampled as part of the quarterly groundwater sampling program required by Illinois EPA closure permit. This will allow for an evaluation of groundwater quality from all of the monitoring well at the site, collected during the same sampling event. Sampling of the RFI monitoring wells will be conducted in the same manner as outlined in the October 27, 2000, RFI Work Plan. Sampling of the landfill monitoring wells will be conducted in accordance with the Illinois EPA approved landfill closure plan.

RESIDENTIAL WELL SAMPLING

The RFI identifies that residents in the area of the site obtain their potable water supply from wells. Many of these wells are less than 100 feet deep and withdraw water from the same formation as the deep RFI monitoring wells. Data collected from the deep monitoring wells suggest that there may be a regional presence of elevated concentration levels of chloroform and boron, and a local presence of elevated iron and manganese. Because of this, it is proposed to sample residential wells in the area. The sampling of these wells will be completed in accordance with the protocol provided by the USEPA (enclosed). These samples will be analyzed for VOCs, metals, and general chemistry parameters.

SCHEDULE

End of June 2001 – complete residential well sampling.

Middle of July 2001 – complete river sediment sampling and installation of additional shallow and deep wells.

End of August 2001 – complete additional round of groundwater sampling.

End of September 2001 – receive laboratory analytical results.

End of October 2001 – submit results of additional data collection.

Clayton
GROUP SERVICES

PROCEDURES FOR SAMPLING PRIVATE WELLS PROVIDED BY USEPA – MAY 22, 2001

C. PROCEDURES

Even though the same care and techniques used in other media sampling (i.e., ensuring that all field equipment is available and in good working order, confirming that sample coolers contain sufficient ice or cool packs to chill all anticipated samples to less than four (4) degrees Centigrade for at least twelve hours, completing chain-of-custody forms, etc.) are used when sampling private water wells, there are certain additional special procedures which shall be used.

1. Primary groundwater parameters for drinking water samples measured in the field, in addition to the specific parameters ordered for laboratory analysis, include pH, specific conductance, and water temperature.

   a. Begin with a clean, well-functioning instrument, and calibrate each day for accuracy by measuring known standards. Follow the instructions provided with the equipment to ensure proper calibration.

   b. Avoid dehydration of sensors, extreme temperatures, and excessive vibration when transporting the instrument to the field. All of these factors can affect the sensitivity of the equipment and damage various parts of the system.

2. To ensure that the water sample is representative of the groundwater, you must avoid altering the sample with outside sources of contamination.

   a. Ask if the owner obtains water from any other sources, i.e. whether water is hauled in.

   b. Wear latex gloves without talc. Latex gloves are also worn to avoid burning your hands with the HCL preservative contained in the vial when filling VOC bottles.

Note: Oftentimes the homeowner will wonder if his/her drinking water is so badly contaminated that we must protect our hands while collecting the sample. Reassure the person that the gloves are used to ensure that the sample collected is not being contaminated by us or to avoid acid burns from the preservatives.

   c. Collect the sample at a point prior to introduction into a water heater, holding tank, cistern, water softener/conditioner, or home filtering system.

   d. Protect the sampling tap from exterior contamination associated with being too close to the sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collecting procedure since it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface.

e. Avoid leaking taps that allow water to flow out from around the stem of the valve handle and down the outside of the faucet, or taps in which water tends to run up on the outside of the lip.

f. Remove any aerator and/or water hose from the tap prior to sample collecting.

3. To obtain a representative sample from private wells, the wells must be purged before the sample is collected.

a. Open the cold water tap to allow for a smooth flow at a moderate pressure. The rate of flow can be measured easily by placing a one-gallon calibrated bucket under the tap and measuring the time required to fill the bucket. The tap must be allowed to run until the temperature, pH, and specific conductivity readings become stabilized to ensure water standing in the well or holding tank is removed.

Often the homeowner will request that you not waste his/her water while purging the well. Therefore, you may want to use this running water on a garden or flower bed. However, the those must be removed prior to collecting the sample.

b. Measure the temperature, pH, and specific conductivity at the initial purging, after ten minutes of purging, and again immediately prior to the sample collection.

c. Record unusual physical characteristics, color, odor or turbidity in the groundwater in the field notes.

d. Do not place the bottle cap on the ground or in a pocket regardless of the type of sample bottle being used.

e. Hold the bottle in one hand and the cap in the other, using care not to touch the inside of the cap.

f. Avoid contaminating the sample bottle with fingers or permitting the faucet to touch the inside of the bottle.

g. Take care when filling any container so splashing drops of water from the ground or sink do not enter into either the bottle or cap.

h. Do not adjust the stream flow while sampling to avoid dislodging particles in the pipe or valve.

4. When collecting drinking water samples for volatile organic chemicals, contract laboratories require that the pH of the sample be lowered by the addition of three drops of 1:1 hydrochloric acid (HCL) to each bottle. Vials obtained from the Bottle Distribution Center already contain the prescribed amount of HCL. Take special care when handling the HCL; wear disposable gloves to avoid burning your hands.

   a. Carefully fill the vial to slightly above the rim but not enough to allow the sample to overflow. Overflowing the bottle will result in loss of the preservative.

   b. Exercise care not to lose the Teflon liner.

   c. Do not rinse the vial, nor excessively overfill it. There should be a convex meniscus on the top of the vial.

   d. Check that the cap has not been contaminated.

   e. Place the sample vial on a level surface.

   f. Position the Teflon side of the septum seal directly over top and upon the convex sample meniscus. For the best results, lower the cap on to the sample - do not place it on the sample sideways; placing the cap on sideways will knock off the meniscus and result in air bubbles in the sample.

   g. Screw the cap down firmly - do not over tighten and break the cap.

   h. Invert the vial and tap gently on the palm of your hand. A successful seal is one in which no air bubbles are present in the sample.

(When collecting drinking water samples for volatile organic contaminants, contract laboratories require five 40 ml vials of water sample. Agency laboratory requires two 40 ml vials)

   i. Pre-label sample bottles appropriately. (Avoid opening permanent or magic marker around open sample vial.)

   j. Wipe off the sample container with paper towel.

   k. Wrap each vial with plastic bubble wrap.

l. Place each set of five into plastic Zip-loc bags and seal baggie with evidence tape.

m. Place into coolers, ensuring four (4) degrees centigrade is maintained surrounding the samples. Do not place vials directly on ice to avoid breaking of bottles.

If air is trapped in the bottle:

- Open the vial and add a few additional drops of water and reseal the bottle as indicted above. If bubbles persist, pour out, obtain a new sample bottle, and repeat entire process.

D. REFERENCES

American Petroleum Institute: Manual of Sampling Analytical Methods for Petroleum Hydrocarbons in Groundwater and Soil., 1990.

Garrett, Peter. How to Sample Groundwater and Soils. 1988.

Hanson, David. "Drinking Water Limits Set for 23 More Compounds." Chemical and Engineering News. June 1, 1992; p 23.

IEPA. A Field Guide for Environmental Sampling. Division of Laboratories.. December 1991.

IEPA. Quality Assurance/Quality Control Procedures fro Groundwater Sampling. Division of Public Water Supply. October 1991.

IEPA. Users Manual for the IEPA Contract Lab Program. Bureau of Land Pollution Control. May 1989.

U.S. EPA. Existing and Proposed U.S. EPA MCLs in Drinking Water. May 1989.

U.S. EPA. Groundwater, Volume II: Methodology. EPA/625/6-90-016b. July 1991: pp 45-63.

U.S. EPA. Handbook for Sampling and Sample Preservation of Water and Wastewater. EPA-600/4-82-029 September 1982: pp 262-265, 370-377.

U.S. EPA. Samplers guide to the Contract Laboratory Program. EPA/540/P-90-006. December 1990: pp 10-14.

APPENDIX O

USEPA REGION 5 ECOLOGICAL DATA QUALITY LEVELS

EPA United States Environmental Protection Agency

CORRECTIVE ACTION

Ecological Data Quality Levels

One component of RCRA Corrective Action is the evaluation of risks to the environment. Risks to the environment are qualitatively and quantitatively evaluated through ecological risk assessments. The Region 5 Ecological Data Quality Levels (EDQLs) are designed as just one of many tools employed in the creation of an ecological risk assessment. The EDQL reference database consists of Region 5 media-specific (soil, water, sediment, and air) EDQLs for RCRA Appendix IX hazardous constituents. The EDQLs are initial screening levels with which the site contaminant concentrations can be compared. The EDQLs help to focus the investigation on those areas and chemicals that are most likely to pose an unacceptable risk to the environment. EDQLs also impact the data requirements for the planning and implementation of field investigations. The ecological risk assessment will be further refined based on the initial screening. EDQLs alone are not intended to serve as cleanup levels.

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- For more information please contact: Daniel Mazur at 312/353-7997 or Meagan Smith at 312/886-4446.

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EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name / CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Acenaphthene 83-32-9	-- mg/m3	9.90 ug/L	10	6.71 ug/kg	660	6.82E+05 ug/kg	660
Acenaphthylene 208-96-8	-- mg/m3	4.84E+03 ug/L	10	5.87 ug/kg	660	6.82E+05 ug/kg	660
Acetone 67-64-1	959.40 mg/m3	7.80E+04 ug/L	100	453.37 ug/kg	100	2.50E+03 ug/kg	100
Acetonitrile 75-05-8	17.10 mg/m3	3.00E+04 ug/L	10	139.05 ug/kg	100	1.37E+03 ug/kg	100
Acetophenone 98-86-2	-- mg/m3	687.89 ug/L	10	246.00 ug/kg	--	3.00E+05 ug/kg	--
Acetylaminofluorene[2-] 53-96-3	-- mg/m3	534.97 ug/L	20	15.32 ug/kg	--	596.34 ug/kg	--
Acrolein 107-02-8	5.78E-01 mg/m3	2.05E-01 ug/L	11	1.44E-02 ug/kg	7	5.27E+03 ug/kg	7
Acrylonitrile 107-13-1	7.97E-01 mg/m3	8.90E-01 ug/L	5	1.57E-02 ug/kg	5	23.93 ug/kg	5
Aldrin 309-00-2	-- mg/m3	3.09E-02 ug/L	0.34	2 ug/kg	22.8	3.32 ug/kg	22.8
Allyl chloride 107-05-1	1.22 mg/m3	-- ug/L	100	2.66E-01 ug/kg	5	13.38 ug/kg	5

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name / CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Aminobiphenyl[4-] 92-67-1	-- mg/m3	-- ug/L	20	5.66 ug/kg	--	3.05 ug/kg	--
Aniline 62-53-3	-- mg/m3	4.40E-01 ug/L	10	3.38E-02 ug/kg	--	56.78 ug/kg	--
Anthracene 120-12-7	-- mg/m3	2.90E-02 ug/L	10	46.9 ug/kg	660	1.48E+06 ug/kg	660
Antimony (Total) 7440-36-0	-- mg/m3	31.00 ug/L	30	-- ug/kg	300	142.30 ug/kg	300
Aramite 140-57-8	-- mg/m3	3.09 ug/L	10	1.11E-03 ug/kg	--	1.66E+05 ug/kg	--
Arsenic (Total) 7440-38-2	-- mg/m3	53.00 ug/L	10	5900 ug/kg	100	5.70E+03 ug/kg	100
Azobenzene[p-(dimethylamino)] 60-11-7	-- mg/m3	1.65 ug/L	10	317.99 ug/kg	--	39.76 ug/kg	--
Barium (Total) 7440-39-3	-- mg/m3	5.00E+03 ug/L	20	-- ug/kg	200	1.04E+03 ug/kg	200
Benzene 71-43-2	9.76 mg/m3	114.00 ug/L	0.09	141.57 ug/kg	0.09	254.62 ug/kg	0.09
Benzo[a]anthracene 56-55-3	-- mg/m3	8.39E-01 ug/L	0.13	31.7 ug/kg	8.7	5.21E+03 ug/kg	8.7

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Benzo[a]pyrene 50-32-8	-- mg/m3	1.40E-02	0.23 ug/L	31.9	15.4 ug/kg	1.52E+03	15.4 ug/kg
Benzo[b]fluoranthene 205-99-2	-- mg/m3	9.07	0.18 ug/L	1.04E+04	12.1 ug/kg	5.98E+04	12.1 ug/kg
Benzo[ghi]perylene 191-24-2	-- mg/m3	7.64	0.76 ug/L	170	51 ug/kg	1.19E+05	51 ug/kg
Benzo[k]fluoranthene 207-08-9	-- mg/m3	5.60E-03	0.17 ug/L	240	11.4 ug/kg	1.48E+05	11.4 ug/kg
Benzyl alcohol 100-51-6	-- mg/m3	281.24	20 ug/L	33.94	1300 ug/kg	6.58E+04	1300 ug/kg
Beryllium (Total) 7440-41-7	-- mg/m3	7.60	2 ug/L	--	20 ug/kg	1.06E+03	20 ug/kg
BHC[alpha-] 319-84-6	-- mg/m3	12.38	0.35 ug/L	6	23.4 ug/kg	99.39	23.4 ug/kg
BHC[beta-] 319-85-7	-- mg/m3	4.95E-01	0.23 ug/L	5	15.4 ug/kg	3.98	15.4 ug/kg
BHC[delta-] 319-86-8	-- mg/m3	666.67	0.24 ug/L	7.15E+04	16.1 ug/kg	9.94E+03	16.1 ug/kg
BHC[gamma-] 58-89-9	-- mg/m3	1.00E-02	0.25 ug/L	0.94	16.8 ug/kg	5.00	16.8 ug/kg

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Bromodichloromethane 75-27-4	-- mg/m3	-- ug/L	0.2	1.13 ug/kg	5	539.78 ug/kg	5
Bromoform 75-25-2	9.11 mg/m3	466.00 ug/L	2	996.27 ug/kg	5	1.59E+04 ug/kg	5
Bromophenyl phenyl ether[4-] 101-55-3	-- mg/m3	1.50 ug/L	10	1.55E+03 ug/kg	660	-- ug/kg	660
Butylamine[N-Nitrosodi-n-] 924-16-3	-- mg/m3	1000.00 ug/L	10	772.04 ug/kg	--	267.07 ug/kg	--
Butylbenzyl phthalate 85-68-7	-- mg/m3	49.00 ug/L	0.42	4.19E+03 ug/kg	660	238.89 ug/kg	660
Cadmium (Total) 7440-43-9	-- mg/m3	6.60E-01 ug/L	1	596 ug/kg	10	2.22 ug/kg	10
Carbon disulfide 75-15-0	3.67 mg/m3	84.10 ug/L	1	133.97 ug/kg	5	94.12 ug/kg	5
Carbon tetrachloride 56-23-5	1.41 mg/m3	5.90 ug/L	1	35.73 ug/kg	5	2.98E+03 ug/kg	5
Chlordane 57-74-9	-- mg/m3	2.90E-04 ug/L	0.37	4.5 ug/kg	24.8	224.00 ug/kg	24.8
Chlorethyl ether[bis(2-] 111-44-4	-- mg/m3	1.14E+03 ug/L	10	211.96 ug/kg	660	2.37E+04 ug/kg	660

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	MRL	Sediment EDQL	MRL	Soil EDQL	MRL
Chloro-1-methylethyl)ether[Bis(2-] 108-60-1	-- mg/m3	20.00 ug/L	10	68.78 ug/kg	660	1.99E+04 ug/kg	660
Chloroaniline[p-] 106-47-8	-- mg/m3	231.97 ug/L	20	146.08 ug/kg	1300	1.10E+03 ug/kg	1300
Chlorobenzene 108-90-7	119.68 mg/m3	10.00 ug/L	0.03	61.94 ug/kg	0.3	1.31E+04 ug/kg	0.3
Chlorobenzilate 510-15-6	-- mg/m3	7.16 ug/L	10	860.29 ug/kg	--	5.05E+03 ug/kg	--
Chloroethane 75-00-3	20.00 mg/m3	2.30E+05 ug/L	1	5.86E+04 ug/kg	5.2	-- ug/kg	5.2
Chloroform 67-66-3	1.34 mg/m3	79.00 ug/L	0.2	27 ug/kg	0.2	1.19E+03 ug/kg	0.2
Chloronaphthalene[2-] 91-58-7	-- mg/m3	3.96E-01 ug/L	10	417.23 ug/kg	630	12.18 ug/kg	630
Chlorophenol[2-] 95-57-8	-- mg/m3	8.80 ug/L	5	11.70 ug/kg	660	242.66 ug/kg	660
Chlorophenyl phenyl ether[4-] 7005-72-3	-- mg/m3	-- ug/L	10	656.12 ug/kg	660	-- ug/kg	660
Chloroprene 126-99-8	4.16E-02 mg/m3	-- ug/L	5	1.06 ug/kg	5	2.90 ug/kg	5

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	 MRL	Sediment EDQL	 MRL	Soil EDQL	 MRL
Chromium (Total) 7440-47-3	-- mg/m3	42.00 ug/L	10	26000 ug/kg	100	400.00 ug/kg	100
Chrysene 218-01-9	-- mg/m3	3.30E-02 ug/L	1.5	57.1 ug/kg	100	4.73E+03 ug/kg	100
Cobalt (Total) 7440-48-4	-- mg/m3	5.00 ug/L	10	50000 ug/kg	100	140.33 ug/kg	100
Copper (Total) 7440-50-8	-- mg/m3	5.00 ug/L	60	16000 ug/kg	600	313.20 ug/kg	600
Cresol[4,6-dinitro-o-] 534-52-1	-- mg/m3	2.30 ug/L	50	10.38 ug/kg	3300	144.08 ug/kg	3300
Cresol[m-] 108-39-4	-- mg/m3	-- ug/L	10	8.45E-01 ug/kg	--	3.49E+03 ug/kg	--
Cresol[o-] 95-48-7	-- mg/m3	-- ug/L	10	8.26E-01 ug/kg	660	4.04E+04 ug/kg	660
Cresol[p-chloro-m-] 59-50-7	-- mg/m3	34.79 ug/L	5	388.18 ug/kg	240	7.95E+03 ug/kg	240
Cresol[p-] 106-44-5	-- mg/m3	-- ug/L	10	8.08E-01 ug/kg	660	1.63E+05 ug/kg	660
Cyanide 57-12-5	-- mg/m3	5.20 ug/L	40	0.1 ug/kg	--	1.33E+03 ug/kg	--

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
DDD[4,4'-] 72-54-8	-- mg/m3	1.10E-03 ug/L	0.5	5.53 ug/kg	33.5	758.15 ug/kg	33.5
DDE[4,4'-] 72-55-9	-- mg/m3	4.51E-09 ug/L	0.6	1.42 ug/kg	38.9	595.87 ug/kg	38.9
DDT[4,4'-] 50-29-3	-- mg/m3	1.00E-03 ug/L	0.8	1.19 ug/kg	54.3	17.50 ug/kg	54.3
Di-n-butyl phthalate 84-74-2	-- mg/m3	3.00 ug/L	3.3	110.50 ug/kg	221	149.79 ug/kg	221
Di-n-octyl phthalate 117-84-0	-- mg/m3	30.00 ug/L	0.5	4.06E+04 ug/kg	32.8	7.09E+05 ug/kg	32.8
Diallate 2303-16-4	-- mg/m3	29.00 ug/L	10	1.51 ug/kg	--	452.14 ug/kg	--
Dibenzofuran 132-64-9	-- mg/m3	20.00 ug/L	10	1.52E+03 ug/kg	660	-- ug/kg	660
Dibenz[a,h]anthracene 53-70-3	-- mg/m3	1.60E-03 ug/L	0.3	6.22 ug/kg	20.1	1.84E+04 ug/kg	20.1
Dibromo-3-chloropropane[1,2-] 96-12-8	3.20E-01 mg/m3	11.20 ug/L	1	19.98 ug/kg	5	35.18 ug/kg	5
Dibromochloromethane 124-48-1	-- mg/m3	6.40E+03 ug/L	0.3	267.61 ug/kg	0.3	2.05E+03 ug/kg	0.3

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Dibromoethane[1,2-] 106-93-4	176.40 mg/m3	22.50 ug/L	1	12.37 ug/kg	5	1.23E+03 ug/kg	5
Dichloro-2-butene[trans-1,4-] 110-57-6	4.03 mg/m3	-- ug/L	1	1.82 ug/kg	5	-- ug/kg	5
Dichlorobenzene[m-] 541-73-1	272.70 mg/m3	87.00 ug/L	0.2	3.01E+03 ug/kg	0.2	3.77E+04 ug/kg	0.2
Dichlorobenzene[o-] 95-50-1	270.00 mg/m3	11.00 ug/L	0.5	231.32 ug/kg	0.5	2.96E+03 ug/kg	0.5
Dichlorobenzene[p-] 106-46-7	275.40 mg/m3	43.00 ug/L	0.07	1.45E+03 ug/kg	0.07	545.59 ug/kg	0.07
Dichlorobenzidine[3,3'-] 91-94-1	-- mg/m3	99.75 ug/L	20	28.22 ug/kg	1300	646.36 ug/kg	1300
Dichlorodifluoromethane 75-71-8	1.55E+03 mg/m3	-- ug/L	1	1.33 ug/kg	5	3.95E+04 ug/kg	5
Dichloroethane[1,1-] 75-34-3	1.24E+03 mg/m3	47.00 ug/L	1	5.75E-01 ug/kg	5	2.01E+04 ug/kg	5
Dichloroethane[1,2-] 107-06-2	29.70 mg/m3	190.00 ug/L	1	54.18 ug/kg	5	2.12E+04 ug/kg	5
Dichloroethene[1,1-] 75-35-4	3.03E-01 mg/m3	78.00 ug/L	0.7	23.27 ug/kg	0.7	8.28E+03 ug/kg	0.7

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	 MRL	Sediment EDQL	 MRL	Soil EDQL	 MRL
Dichloroethylene[trans-1,2-] 156-60-5	29.09 mg/m3	310.00 ug/L	1	208.94 ug/kg	5	783.73 ug/kg	5
Dichlorophenol[2,4-] 120-83-2	-- mg/m3	18.00 ug/L	5	133.63 ug/kg	260	8.75E+04 ug/kg	260
Dichlorophenol[2,6-] 87-65-0	-- mg/m3	-- ug/L	10	3.94 ug/kg	--	1.17E+03 ug/kg	--
Dichloropropane[1,2-] 78-87-5	70.60 mg/m3	380.00 ug/L	0.06	351.61 ug/kg	5	3.27E+04 ug/kg	5
Dichloropropene[cis-1,3-] 10061-01-5	5.89 mg/m3	7.90 ug/L	1	2.96 ug/kg	5	397.86 ug/kg	5
Dichloropropene[trans-1,3-] 10061-02-6	5.89 mg/m3	7.90 ug/L	1	2.96 ug/kg	5	397.86 ug/kg	5
Dieldrin 60-57-1	-- mg/m3	2.60E-05 ug/L	0.44	2 ug/kg	29.5	2.38 ug/kg	29.5
Diethyl O-2-pyrazinyl phosphorothioate[O,O-] 297-97-2	-- mg/m3	-- ug/L	20	4.88E-02 ug/kg	--	799.49 ug/kg	--
Diethyl phthalate 84-66-2	-- mg/m3	3.00 ug/L	2.5	8.04 ug/kg	168	2.48E+04 ug/kg	168
Dimethoate 60-51-5	-- mg/m3	41.20 ug/L	2.6	190.15 ug/kg	130	218.02 ug/kg	130

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name / CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Dimethyl phthalate 131-11-3	-- mg/m3	73.00 ug/L	6.4	24.95 ug/kg	429	7.34E+05 ug/kg	429
Dimethylbenzidine[3,3'-] 119-93-7	-- mg/m3	-- ug/L	10	2.00 ug/kg	--	104.20 ug/kg	--
Dimethylbenz[a]anthracene[7,12-] 57-97-6	-- mg/m3	5.48E-01 ug/L	10	6.64E+04 ug/kg	--	1.63E+04 ug/kg	--
Dimethylphenethylamine[alpha,alpha-] 122-09-8	-- mg/m3	-- ug/L	10	8.90 ug/kg	--	300.16 ug/kg	--
Dimethylphenol[2,4-] 105-67-9	-- mg/m3	100.17 ug/L	5	304.53 ug/kg	660	10.00 ug/kg	660
Dinitrobenzene[m-] 99-65-0	-- mg/m3	2.36 ug/L	0.11	9.24E-01 ug/kg	0.25	654.70 ug/kg	0.25
Dinitrophenol[2,4-] 51-28-5	-- mg/m3	4.07 ug/L	50	11.33 ug/kg	3300	60.86 ug/kg	3300
Dinitrotoluene[2,4-] 121-14-2	-- mg/m3	230.00 ug/L	0.02	75.13 ug/kg	0.25	1.28E+03 ug/kg	0.25
Dinitrotoluene[2,6-] 606-20-2	-- mg/m3	42.00 ug/L	0.1	20.62 ug/kg	0.26	32.83 ug/kg	0.26
Dinoseb 88-85-7	-- mg/m3	3.90E-01 ug/L	1	11.78 ug/kg	47	21.80 ug/kg	47

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Dioxane[1,4-] 123-91-1	367.20 mg/m3	-- ug/L	12	5.43E-03 ug/kg	--	2.05E+03 ug/kg	--
Diphenylamine 122-39-4	-- mg/m3	412.51 ug/L	10	34.60 ug/kg	--	1.01E+03 ug/kg	--
Disulfoton 298-04-4	-- mg/m3	4.02E-02 ug/L	0.7	324.08 ug/kg	35	19.88 ug/kg	35
D[2,4-] 94-75-7	-- mg/m3	-- ug/L	0.2	5.79 ug/kg	1.2	27.25 ug/kg	1.2
Endosulfan I 959-98-8	-- mg/m3	3.00E-03 ug/L	0.3	1.75E-01 ug/kg	20.1	119.27 ug/kg	20.1
Endosulfan II 33213-65-9	-- mg/m3	3.00E-03 ug/L	0.4	1.04E-01 ug/kg	26.8	119.27 ug/kg	26.8
Endosulfan sulfate 1031-07-8	-- mg/m3	2.22 ug/L	0.35	34.60 ug/kg	23.4	35.78 ug/kg	23.4
Endrin 72-20-8	-- mg/m3	2.00E-03 ug/L	0.39	2.67 ug/kg	26.1	10.10 ug/kg	26.1
Endrin aldehyde 7421-93-4	-- mg/m3	1.50E-01 ug/L	0.5	3.20E+03 ug/kg	33.5	10.50 ug/kg	33.5
Ethyl methacrylate 97-63-2	355.50 mg/m3	-- ug/L	5	6.02E-01 ug/kg	5	3.00E+04 ug/kg	5

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name / CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Ethyl methane sulfonate 62-50-0	-- mg/m3	-- ug/L	20	1.61E-02 ug/kg	--	-- ug/kg	--
Ethylbenzene 100-41-4	304.20 mg/m3	17.20 ug/L	0.05	0.1 ug/kg	0.05	5.16E+03 ug/kg	0.05
Famphur 52-85-7	-- mg/m3	-- ug/L	20	1.78 ug/kg	--	49.70 ug/kg	--
Fluoranthene 206-44-0	-- mg/m3	8.10 ug/L	2.1	111.3 ug/kg	660	1.22E+05 ug/kg	660
Fluorene 86-73-7	-- mg/m3	3.90 ug/L	2.1	21.2 ug/kg	660	1.22E+05 ug/kg	660
Heptachlor 76-44-8	-- mg/m3	3.90E-04 ug/L	0.4	0.6 ug/kg	26.8	5.98 ug/kg	26.8
Heptachlor epoxide 1024-57-3	-- mg/m3	4.80E-04 ug/L	0.32	0.6 ug/kg	21.4	151.88 ug/kg	21.4
Hexachlorobenzene 118-74-1	-- mg/m3	2.40E-04 ug/L	0.056	20 ug/kg	3.8	198.78 ug/kg	3.8
Hexachlorobutadiene 87-68-3	-- mg/m3	2.23E-01 ug/L	0.014	1.38E+03 ug/kg	0.9	39.76 ug/kg	0.9
Hexachlorocyclopentadiene 77-47-4	-- mg/m3	77.04 ug/L	2.4	900.74 ug/kg	161	755.37 ug/kg	161

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Hexachloroethane 67-72-1	-- mg/m3	30.50 ug/L	0.016	2.23E+03 ug/kg	1.1	596.34 ug/kg	1.1
Hexachlorophene 70-30-4	-- mg/m3	2.28E-01 ug/L	50	2.31E+05 ug/kg	--	198.78 ug/kg	--
Hexachloropropene 1888-71-7	-- mg/m3	20.00 ug/L	50	2.00E-01 ug/kg	--	-- ug/kg	--
Hexanone[2-] 591-78-6	105.23 mg/m3	1.71E+03 ug/L	50	1.01E+03 ug/kg	50	1.26E+04 ug/kg	50
Indeno(1,2,3-cd)pyrene 193-39-5	-- mg/m3	4.31 ug/L	0.43	200 ug/kg	29	1.09E+05 ug/kg	29
Isobutyl alcohol 78-83-1	32.81 mg/m3	3.48E+04 ug/L	50	3.35E+03 ug/kg	7	2.08E+04 ug/kg	7
Isodrin 465-73-6	-- mg/m3	3.09E-02 ug/L	20	55.16 ug/kg	--	3.32 ug/kg	--
Isophorone 78-59-1	-- mg/m3	900.00 ug/L	10	422.30 ug/kg	3800	1.39E+05 ug/kg	3800
Isosafrole 120-58-1	-- mg/m3	-- ug/L	10	4.12 ug/kg	--	9.94E+03 ug/kg	--
Kepone 143-50-0	-- mg/m3	1.32E-01 ug/L	20	3.31 ug/kg	--	32.72 ug/kg	--

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name / CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Lead (Total) 7439-92-1	-- mg/m3	1.30 ug/L	10	31000 ug/kg	100	53.73 ug/kg	100
Mercury (Total) 7439-97-6	-- mg/m3	1.30E-03 ug/L	2	174 ug/kg	100	100.00 ug/kg	100
Methacrylonitrile 126-98-7	3.38 mg/m3	-- ug/L	5	2.97E-02 ug/kg	100	57.05 ug/kg	100
Methane[bis(2-chloroethoxy)] 111-91-1	-- mg/m3	6.40E+03 ug/L	10	349.71 ug/kg	660	302.09 ug/kg	660
Methapyrilene 91-80-5	-- mg/m3	-- ug/L	100	1.44E-02 ug/kg	--	2.78E+03 ug/kg	--
Methoxychlor 72-43-5	-- mg/m3	5.00E-03 ug/L	0.86	3.59 ug/kg	57.6	19.88 ug/kg	57.6
Methyl bromide 74-83-9	26.52 mg/m3	-- ug/L	1	1.48E-01 ug/kg	10	235.16 ug/kg	10
Methyl chloride 74-87-3	2.63 mg/m3	-- ug/L	1	7.85E-02 ug/kg	0.8	1.04E+04 ug/kg	0.8
Methyl ethyl ketone 78-93-3	641.70 mg/m3	7.10E+03 ug/L	10	136.96 ug/kg	100	8.96E+04 ug/kg	100
Methyl iodide 74-88-4	11.70 mg/m3	-- ug/L	5	3.05E-01 ug/kg	5	1.23E+03 ug/kg	5

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Methyl mercury 22967-92-6	-- mg/m3	2.46E-03 ug/L	Variable	1.00E-02 ug/kg	Variable	1.58 ug/kg	Variable
Methyl methacrylate 80-62-6	87.12 mg/m3	2.80E+03 ug/L	2	167.56 ug/kg	50	9.84E+05 ug/kg	50
Methyl methanesulfanate 66-27-3	-- mg/m3	-- ug/L	10	4.74E-03 ug/kg	--	315.49 ug/kg	--
Methyl parathion 298-00-0	-- mg/m3	-- ug/L	0.5	7.55E-01 ug/kg	20	2.92E-01 ug/kg	20
Methyl-2-pentanone[4-] 108-10-1	45.90 mg/m3	3.68E+03 ug/L	5	544.37 ug/kg	50	4.43E+05 ug/kg	50
Methylcholanthrene[3-] 56-49-5	-- mg/m3	8.91E-02 ug/L	10	8.19E+06 ug/kg	--	77.94 ug/kg	--
Methylene bromide 74-95-3	343.90 mg/m3	-- ug/L	1	8.59E-02 ug/kg	5	6.50E+04 ug/kg	5
Methylene chloride 75-09-2	4.78E+03 mg/m3	430.00 ug/L	1	1260 ug/kg	5	4.05E+03 ug/kg	5
Methylnaphthalene[2-] 91-57-6	-- mg/m3	329.55 ug/L	10	20.2 ug/kg	660	3.24E+03 ug/kg	660
Naphthalene 91-20-3	80.13 mg/m3	44.00 ug/L	10	34.6 ug/kg	660	99.39 ug/kg	660

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Naphthoquinone[1,4-] 130-15-4	- - mg/m3	4.40E-02 ug/L	10	2.11E-02 ug/kg	- -	1.67E+03 ug/kg	- -
Naphthylamine[1-] 134-32-7	- - mg/m3	6.70E-01 ug/L	10	1.09 ug/kg	- -	9.34E+03 ug/kg	- -
Naphthylamine[2-] 91-59-8	- - mg/m3	- - ug/L	10	1.74 ug/kg	- -	3.03E+03 ug/kg	- -
Nickel (Total) 7440-02-0	- - mg/m3	29.00 ug/L	50	16000 ug/kg	1500	1.36E+04 ug/kg	1500
Nitroaniline[m-] 99-09-2	- - mg/m3	- - ug/L	33	2.22E-01 ug/kg	2211	3.16E+03 ug/kg	2211
Nitroaniline[o-] 88-74-4	- - mg/m3	- - ug/L	10	2.22E-01 ug/kg	670	7.41E+04 ug/kg	670
Nitroaniline[p-] 100-01-6	- - mg/m3	- - ug/L	20	2.22E-01 ug/kg	7370	2.19E+04 ug/kg	7370
Nitrobenzene 98-95-3	- - mg/m3	740.00 ug/L	6.4	487.60 ug/kg	0.26	1.31E+03 ug/kg	0.26
Nitrophenol[o-] 88-75-5	- - mg/m3	13.50 ug/L	5	7.77 ug/kg	300	1.60E+03 ug/kg	300
Nitrophenol[p-] 100-02-7	- - mg/m3	35.00 ug/L	10	7.78 ug/kg	470	5.12E+03 ug/kg	470

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Nitroquinoline-1-oxide[4-] 56-57-5	-- mg/m3	-- ug/L	40	1.24 ug/kg	--	122.22 ug/kg	--
Nitrosodiethylamine[N-] 55-18-5	-- mg/m3	767.94 ug/L	20	22.77 ug/kg	--	69.33 ug/kg	--
Nitrosodimethylamine[N-] 62-75-9	-- mg/m3	-- ug/L	1.5	2.75E-03 ug/kg	--	3.21E-02 ug/kg	--
Nitrosodiphenylamine[N-] 86-30-6	-- mg/m3	13.00 ug/L	8.1	155.24 ug/kg	660	545.14 ug/kg	660
Nitrosomethylethylamine[N-] 10595-95-6	-- mg/m3	-- ug/L	10	4.85E-03 ug/kg	--	1.66 ug/kg	--
Nitrosomorpholine[N-] 59-89-2	-- mg/m3	-- ug/L	10	3.70E-03 ug/kg	--	70.57 ug/kg	--
Nitrosopiperidine[N-] 100-75-4	-- mg/m3	-- ug/L	20	2.26E-02 ug/kg	--	6.65 ug/kg	--
Nitrosopyrrolidine[N-] 930-55-2	-- mg/m3	-- ug/L	40	9.08E-04 ug/kg	--	12.56 ug/kg	--
Parathion 56-38-2	-- mg/m3	8.00E-03 ug/L	10	3.40E-01 ug/kg	--	3.40E-01 ug/kg	--
Pentachlorobenzene 608-93-5	-- mg/m3	4.70E-01 ug/L	10	1.26E+03 ug/kg	--	496.95 ug/kg	--

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	MRL	Sediment EDQL	MRL	Soil EDQL	MRL
Pentachloroethane 76-01-7	6.80E-01 mg/m3	56.42 ug/L	5	689.18 ug/kg	10	1.07E+04 ug/kg	10
Pentachloronitrobenzene 82-68-8	-- mg/m3	50.00 ug/L	20	1.82E+04 ug/kg	--	7.09E+03 ug/kg	--
Pentachlorophenol 87-86-5	-- mg/m3	5.23 ug/L	0.076	3.01E+04 ug/kg	400	119.27 ug/kg	400
Phenacetin 62-44-2	-- mg/m3	6.30 ug/L	20	2.25 ug/kg	--	1.17E+04 ug/kg	--
Phenanthrene 85-01-8	-- mg/m3	2.10 ug/L	10	41.9 ug/kg	660	4.57E+04 ug/kg	660
Phenol 108-95-2	4.31 mg/m3	100.00 ug/L	1	27.26 ug/kg	94	1.20E+05 ug/kg	94
Phenylenediamine[p-] 106-50-3	-- mg/m3	-- ug/L	10	5.68E-03 ug/kg	--	6.16E+03 ug/kg	--
Phorate 298-02-2	-- mg/m3	3.62 ug/L	0.4	8.61E-01 ug/kg	20	4.96E-01 ug/kg	20
Phthalate[bis(2-ethylhexyl)] 117-81-7	-- mg/m3	2.10 ug/L	2.7	182 ug/kg	181	925.94 ug/kg	181
Picoline[2-] 109-06-8	139.68 mg/m3	3.79E+03 ug/L	5	753.05 ug/kg	--	9.90E+03 ug/kg	--

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name / CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Polychlorinated biphenyls 1336-36-3	-- mg/m3	2.90E-05 ug/L	5.4	34.1 ug/kg	36.2	3.32E-01 ug/kg	36.2
Polychlorinated dibenzo-p-dioxins PCDD-S	-- mg/m3	2.78E-07 ug/L	0.01	0.0033 ug/kg	--	1.99E-04 ug/kg	--
Polychlorinated dibenzofurans 51207-31-9	-- mg/m3	1.29E-03 ug/L	0.01	1.29E-05 ug/kg	--	3.86E-02 ug/kg	--
Pronamide 23950-58-5	-- mg/m3	160.00 ug/L	10	1.60 ug/kg	--	13.60 ug/kg	--
Propionitrile 107-12-0	1.87 mg/m3	6.08E+03 ug/L	5	114.66 ug/kg	100	49.83 ug/kg	100
Propylamine[N-nitrosodi-n-] 621-64-7	-- mg/m3	-- ug/L	4.6	2.17E-01 ug/kg	660	543.68 ug/kg	660
Pyrene 129-00-0	-- mg/m3	3.00E-01 ug/L	2.7	53 ug/kg	660	7.85E+04 ug/kg	660
Pyridine 110-86-1	13.68 mg/m3	2.38E+03 ug/L	5	106.17 ug/kg	--	1.03E+03 ug/kg	--
Safrole 94-59-7	-- mg/m3	40.00 ug/L	10	164.86 ug/kg	--	403.98 ug/kg	--
Selenium (Total) 7782-49-2	-- mg/m3	5.00 ug/L	20	-- ug/kg	200	27.65 ug/kg	200

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Silver (Total) 7440-22-4	-- mg/m3	1.00E+00 ug/L	70	500 ug/kg	700	4.04E+03 ug/kg	700
Silvex 93-72-1	-- mg/m3	326.64 ug/L	0.75	7.35E+03 ug/kg	0.28	108.80 ug/kg	0.28
Styrene 100-42-5	9.46E-01 mg/m3	56.00 ug/L	1	444.96 ug/kg	5	4.69E+03 ug/kg	5
Sulfide 18496-25-8	-- mg/m3	-- ug/L	10000	-- ug/kg	--	3.58 ug/kg	--
Tetrachlorobenzene[1,2,4,5-] 95-94-3	-- mg/m3	26.24 ug/L	10	2.09E+04 ug/kg	--	2.02E+03 ug/kg	--
Tetrachlorodibenzo-p-dioxin[2,3,7,8-] 1746-01-6	-- mg/m3	3.00E-07 ug/L	0.01	0.0033 ug/kg	0.8	1.99E-04 ug/kg	0.8
Tetrachloroethane[1,1,1,2-] 630-20-6	22.50 mg/m3	90.25 ug/L	1	10.89 ug/kg	5	2.25E+05 ug/kg	5
Tetrachloroethane[1,1,2,2-] 79-34-5	352.80 mg/m3	13.00 ug/L	1	29.08 ug/kg	5	127.22 ug/kg	5
Tetrachloroethene 127-18-4	69.00 mg/m3	8.90 ug/L	0.4	195.83 ug/kg	0.4	9.92E+03 ug/kg	0.4
Tetrachlorophenol[2,3,4,6-] 58-90-2	-- mg/m3	14.06 ug/L	10	1.51E+03 ug/kg	--	198.78 ug/kg	--

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Tetraethyl dithiopyrophosphate 3689-24-5	-- mg/m3	13.90	0.7 ug/L	559.98	35 ug/kg	596.34	35 ug/kg
Thallium (Total) 7440-28-0	-- mg/m3	5.60E-01	10 ug/L	--	100 ug/kg	56.92	100 ug/kg
Tin (Total) 7440-31-5	-- mg/m3	73.00	8000 ug/L	--	2000 ug/kg	7.62E+03	2000 ug/kg
Toluene 108-88-3	1.04E+03 mg/m3	253.00	1 ug/L	52500	2 ug/kg	5.45E+03	2 ug/kg
Toluidine[5-nitro-o-] 99-55-8	-- mg/m3	--	10 ug/L	8.45E-01	-- ug/kg	8.73E+03	-- ug/kg
Toluidine[o-] 95-53-4	-- mg/m3	--	10 ug/L	1.99E-01	-- ug/kg	2.97E+03	-- ug/kg
Toxaphene 8001-35-2	-- mg/m3	2.00E-04	0.86 ug/L	1.09E-01	57.6 ug/kg	119.27	57.6 ug/kg
Trichlorobenzene[1,2,4-] 120-82-1	-- mg/m3	69.20	1 ug/L	1.17E+04	34 ug/kg	1.11E+04	34 ug/kg
Trichloroethane[1,1,1-] 71-55-6	4.17E+03 mg/m3	88.00	1 ug/L	246.85	5 ug/kg	2.98E+04	5 ug/kg
Trichloroethane[1,1,2-] 79-00-5	11.56 mg/m3	650.00	1 ug/L	673.51	0.2 ug/kg	2.86E+04	0.2 ug/kg

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name	Air	Surface Water		Sediment		Soil	
CAS Number	EDQL	EDQL	MRL	EDQL	MRL	EDQL	MRL
Trichloroethylene 79-01-6	1.22E+03 mg/m3	75.00 ug/L	0.1	179.56 ug/kg	0.1	1.24E+04 ug/kg	0.1
Trichlorofluoromethane 75-69-4	5.15E+03 mg/m3	-- ug/L	0.3	3.07 ug/kg	0.3	1.64E+04 ug/kg	0.3
Trichlorophenol[2,4,5-] 95-95-4	-- mg/m3	-- ug/L	10	85.56 ug/kg	660	1.41E+04 ug/kg	660
Trichlorophenol[2,4,6-] 88-06-2	-- mg/m3	2.00 ug/L	5	84.84 ug/kg	390	9.94E+03 ug/kg	390
Trichloropropane[1,2,3-] 96-18-4	3.32 mg/m3	12.11 ug/L	1	8.35 ug/kg	4	3.36E+03 ug/kg	4
Trichlorphenoxyacetic acid[2,4,5-] 93-76-5	-- mg/m3	686.33 ug/L	0.8	5.87E+04 ug/kg	130	596.34 ug/kg	130
Triethyl phosphorothioate[O,O,O-] 126-68-1	-- mg/m3	58.25 ug/L	10	188.94 ug/kg	--	817.57 ug/kg	--
Trinitrobenzene[Sym-] 99-35-4	-- mg/m3	-- ug/L	0.26	1.21E-01 ug/kg	250	376.15 ug/kg	250
Vanadium (Total) 7440-62-2	-- mg/m3	19.00 ug/L	40	-- ug/kg	--	1.59E+03 ug/kg	--
Vinyl acetate 108-05-4	359.00 mg/m3	248.03 ug/L	5	12.95 ug/kg	50	1.27E+04 ug/kg	50

EDQL, MRL VALUES FOR ALL MEDIA

Chemical Name CAS Number	Air EDQL	Surface Water EDQL	Surface Water MRL	Sediment EDQL	Sediment MRL	Soil EDQL	Soil MRL
Vinyl chloride 75-01-4	2.21E-01 mg/m3	9.20 ug/L	0.2	2.00 ug/kg	0.2	646.14 ug/kg	0.2
Xylenes (total) 1330-20-7	134.80 mg/m3	117.00 ug/L	0.1	1.88E+03 ug/kg	0.1	1.00E+04 ug/kg	0.1
Zinc (Total) 7440-66-6	-- mg/m3	58.90 ug/L	20	120000 ug/kg	200	6.62E+03 ug/kg	200

Clayton
GROUP SERVICES

APPENDIX P

LABORATORY ANALYTICAL RESULTS
WATER USED TO COMPLETE SOIL BORINGS

Detroit Regional Office

22345 Roethel Drive
Novi, MI 48375
248.344.1770
Fax 248.344.2654
www.claytongrp.com

Clayton GROUP SERVICES

October 18, 2001

Monte M. Nienkerk
CLAYTON GROUP SERVICES
3140 Finley Road
Downers Grove, IL 60515

Clayton Work Order No. 01100299

Reference: 15-00116.03/Millenium Petrochemical

Dear Monte M. Nienkerk:

Clayton Group Services received 3 samples on 10/09/2001 for the analyses presented in the following report.

Enclosed is a copy of the Chain-of-Custody record acknowledging receipt of these samples. Please note that any unused portion of the samples will be discarded 30 days after the date of this report, unless you have requested otherwise.

We appreciate the opportunity to assist you. If you have any questions concerning this report, please contact a Client Services Representative at (800) 806-5887.

Sincerely,

Jane Rusin

Jane Rusin
Client Service Representative

cc:

Work Order Sample Summary

Date: *18-Oct-01*

CLIENT: CLAYTON GROUP SERVICES
Project: 15-00116.03/Millenium Petrochemical
Work Order: 01100299
Date Received: 10/9/2001

Lab Sample ID	Client Sample ID	Tag Number	Collection Date
01100299-001A	HW1-100108		10/8/2001 9:55:00 AM
01100299-002A	TRIP BLANK		10/8/2001
01100299-003A	LAB BLANK		10/8/2001

Clayton GROUP SERVICES

CASE NARRATIVE

Date: *18-Oct-01*

CLIENT:	CLAYTON GROUP SERVICES
Project:	15-00116.03/Millenium Petrochemical
Work Order No	01100299

Analytical comments:
The Clayton Novi Laboratory is NELAP and AIHA accredited. These accreditations require that we provide the following information on each report: As an analytical result progresses above the reporting limit (RL), it has less variability than a result reported at, or near, the RL.

The client sample was received without an identification label.

The client sample was received on ice at an average temperature of 8.4 degrees Celsius.

Clayton GROUP SERVICES

ANALYTICAL RESULTS

Date: *18-Oct-01*

CLIENT:	CLAYTON GROUP SERVICES	**Client Sample ID:**	HW1-100108
Work Order No:	01100299	**Tag Number:**	
Project:	15-00116.03/Millenium Petrochemical	**Collection Date:**	10/08/2001 9:55:00 AM
Lab ID:	01100299-001A	**Matrix:**	AQUEOUS

Analyses	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
GC/MS VOLATILES; METHOD EPA 8260B						Analyst: **DRS**
Acetone	ND	100		µg/L	1	10/09/2001 2:12:00 PM
Benzene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Bromodichloromethane	7.3	1.0		µg/L	1	10/09/2001 2:12:00 PM
Bromoform	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Bromomethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
2-Butanone	ND	50		µg/L	1	10/09/2001 2:12:00 PM
Carbon Disulfide	ND	50		µg/L	1	10/09/2001 2:12:00 PM
Carbon tetrachloride	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Chlorobenzene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Chloroethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Chloroform	48	1.0		µg/L	1	10/09/2001 2:12:00 PM
Chloromethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Dibromochloromethane	1.1	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,2-Dichlorobenzene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/L	1	10/09/2001 2:12:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/L	1	10/09/2001 2:12:00 PM
1,1-Dichloroethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,2-Dichloroethane	ND	5.0		µg/L	1	10/09/2001 2:12:00 PM
1,1-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
cis-1,2-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
trans-1,2-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,2-Dichloropropane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Ethylbenzene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
2-Hexanone	ND	50		µg/L	1	10/09/2001 2:12:00 PM
4-Methyl-2-Pentanone	ND	50		µg/L	1	10/09/2001 2:12:00 PM
Methylene Chloride	ND	5.0		µg/L	1	10/09/2001 2:12:00 PM
Styrene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,1,2,2-Tetrachloroethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Tetrachloroethene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Toluene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,1,1-Trichloroethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
1,1,2-Trichloroethane	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Trichloroethene	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Vinyl Acetate	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Vinyl Chloride	ND	1.0		µg/L	1	10/09/2001 2:12:00 PM
Xylenes, Total	ND	3.0		µg/L	1	10/09/2001 2:12:00 PM

Qualifiers:

ND - Not Detected at the Reporting Limit (RL).

J - Analyte detected below the Reporting Limit

B - Analyte detected in the associated Method Blank

* - Value exceeds Maximum Contaminant Level

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

T - Tentatively Identified Compound (TIC)

Clayton GROUP SERVICES

ANALYTICAL RESULTS

Date: *18-Oct-01*

CLIENT:	CLAYTON GROUP SERVICES	**Client Sample ID:**	TRIP BLANK
Work Order No:	01100299	**Tag Number:**	
Project:	15-00116.03/Millenium Petrochemical	**Collection Date:**	10/08/2001
Lab ID:	01100299-002A	**Matrix:**	AQUEOUS

Analyses	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
GC/MS VOLATILES; METHOD EPA 8260B						Analyst: **DRS**
Acetone	ND	100		µg/L	1	10/09/2001 1:37:00 PM
Benzene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Bromodichloromethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Bromoform	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Bromomethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
2-Butanone	ND	50		µg/L	1	10/09/2001 1:37:00 PM
Carbon Disulfide	ND	50		µg/L	1	10/09/2001 1:37:00 PM
Carbon tetrachloride	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Chlorobenzene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Chloroethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Chloroform	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Chloromethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Dibromochloromethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,2-Dichlorobenzene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/L	1	10/09/2001 1:37:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/L	1	10/09/2001 1:37:00 PM
1,1-Dichloroethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,2-Dichloroethane	ND	5.0		µg/L	1	10/09/2001 1:37:00 PM
1,1-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
cis-1,2-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
trans-1,2-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,2-Dichloropropane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Ethylbenzene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
2-Hexanone	ND	50		µg/L	1	10/09/2001 1:37:00 PM
4-Methyl-2-Pentanone	ND	50		µg/L	1	10/09/2001 1:37:00 PM
Methylene Chloride	24	5.0		µg/L	1	10/09/2001 1:37:00 PM
Styrene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,1,2,2-Tetrachloroethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Tetrachloroethene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Toluene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,1,1-Trichloroethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
1,1,2-Trichloroethane	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Trichloroethene	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Vinyl Acetate	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Vinyl Chloride	ND	1.0		µg/L	1	10/09/2001 1:37:00 PM
Xylenes, Total	ND	3.0		µg/L	1	10/09/2001 1:37:00 PM

Qualifiers:

ND - Not Detected at the Reporting Limit (RL).
J - Analyte detected below the Reporting Limit
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
T - Tentatively Identified Compound (TIC)

Clayton
GROUP SERVICES

QC SUMMARY REPORT

Workorder # 01100299

ANALYTICAL RESULTS

Date: *18-Oct-01*

CLIENT:	CLAYTON GROUP SERVICES	**Client Sample ID:**	LAB BLANK
Work Order No:	01100299	**Tag Number:**	
Project:	15-00116.03/Millenium Petrochemical	**Collection Date:**	10/08/2001
Lab ID:	01100299-003A	**Matrix:**	AQUEOUS

Analyses	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
GC/MS VOLATILES; METHOD EPA 8260B						Analyst: **DRS**
Acetone	ND	100		µg/L	1	10/09/2001 12:45:00 PM
Benzene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Bromodichloromethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Bromoform	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Bromomethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
2-Butanone	ND	50		µg/L	1	10/09/2001 12:45:00 PM
Carbon Disulfide	ND	50		µg/L	1	10/09/2001 12:45:00 PM
Carbon tetrachloride	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Chlorobenzene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Chloroethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Chloroform	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Chloromethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Dibromochloromethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,2-Dichlorobenzene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/L	1	10/09/2001 12:45:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/L	1	10/09/2001 12:45:00 PM
1,1-Dichloroethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,2-Dichloroethane	ND	5.0		µg/L	1	10/09/2001 12:45:00 PM
1,1-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
cis-1,2-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
trans-1,2-Dichloroethene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,2-Dichloropropane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Ethylbenzene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
2-Hexanone	ND	50		µg/L	1	10/09/2001 12:45:00 PM
4-Methyl-2-Pentanone	ND	50		µg/L	1	10/09/2001 12:45:00 PM
Methylene Chloride	ND	5.0		µg/L	1	10/09/2001 12:45:00 PM
Styrene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,1,2,2-Tetrachloroethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Tetrachloroethene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Toluene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,1,1-Trichloroethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
1,1,2-Trichloroethane	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Trichloroethene	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Vinyl Acetate	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Vinyl Chloride	ND	1.0		µg/L	1	10/09/2001 12:45:00 PM
Xylenes, Total	ND	3.0		µg/L	1	10/09/2001 12:45:00 PM

Qualifiers:

ND - Not Detected at the Reporting Limit (RL).
J - Analyte detected below the Reporting Limit
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
T - Tentatively Identified Compound (TIC)

Spike Recovery and RPD Summary Report - WATER

Method : M:\3C\METHODS\8260W03.M (RTE Integrator)
Title : GC/MS
ᵀ⁻ast Update : Tue Sep 11 08:18:00 2001
ˢponse via : Initial Calibration

Non-Spiked Sample: C5469.D

	Spike Sample	Spike Duplicate Sample
File ID :	C5470.D	C5471.D
Sample :	01100299-001A 8260W MILLENNIUM	01100299-00
Acq Time:	9 Oct 2001 14:48	9 Oct 2001 15:26

Compound	Sample Conc	Spike Added	Spike Res	Dup Res	Spike %Rec	Dup %Rec	RPD	QC Limits RPD	QC Limits % Rec
1,1-Dichloroethene	0.0	50	53	51	107	101	5	14	61-145
Benzene	0.0	50	51	52	102	103	1	11	76-127
Trichloroethene	0.0	50	50	51	99	102	2	14	71-120
Toluene	0.2	50	52	50	104	101	3	13	76-125
Chlorobenzene	0.0	50	51	49	102	98	4	13	75-130

- Fails Limit Check

Clayton Group Services

INTERDEPARTMENTAL INTERNAL CHAIN-OF-CUSTODY

Page 1 of 1

IMPORTANT
Date Results Requested: 48 hr.
Rush Charges Authorized? [X] Yes [ ] No

For Clayton Lab Use Only
Clayton Lab Project No. 0100299

INTERDEPARTMENTAL INFORMATION
Consultant's Name: Monk Nienkerk
Consultant's Office Location: Downers Grove, IL
Consultant's Internal Project No. 15.00116.03.002

OUTSIDE CLIENT INFORMATION
CFMS Client Code:
Company Name: Millennium Petrochemicals
Client Name:
Mailing Address:
Telephone No.:
City, State, Zip: Tuscola, IL ~~too~~

PRICING INFORMATION
[ ] Fee Schedule Price
[ ] Discount Price . % off list ______
[ ] Special Price Attached

Send Report to: [ ] Client [X] Internal Office
Send Via: [ ] Reg. Mail [ ] Overnight Mail [ ] Fax Fax # e-mail

Special instructions:
- Detection limits per Monk Nienkerk
*48 hr turnaround

Routine QA Acceptable? [ ] Yes [X] No
Routine Detection Limits Acceptable? [ ] Yes [X] No
Routine Analyte List Acceptable? [X] Yes [ ] No

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request; Enter a 'P' if Preservative added.*)

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	VOCs									FOR LAB USE ONLY
HWI-100108	10-8-01	0955	H_2O	—	3	X									
trip blank	—	—	—	—	1	X									

CHAIN OF CUSTODY
Collected by: Marie Eddy (print) Collector's Signature: Marie Eddy
Relinquished by: Marie Eddy Date/Time 10-8-01 Received by: Date/Time
Relinquished by: Date/Time Received by: [signature] Date/Time 10/9 10:45
Authorized by: Date Sample Condition Upon Receipt: [ ] Acceptable [ ] Other (explain)
(Client Signature MUST Accompany Request)

8.1 7.9.9.1

Please return completed form and samples to one of the Clayton Laboratory Services locations below:
Detroit Regional Lab: (800) 806-5887 Atlanta Regional Lab: (800) 252-9919
San Francisco Regional Lab: (800) 294-1755 Seattle Regional Lab: (800) 568-7755

Distribution:
White & Yellow: Lab
Pink: Consultant

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